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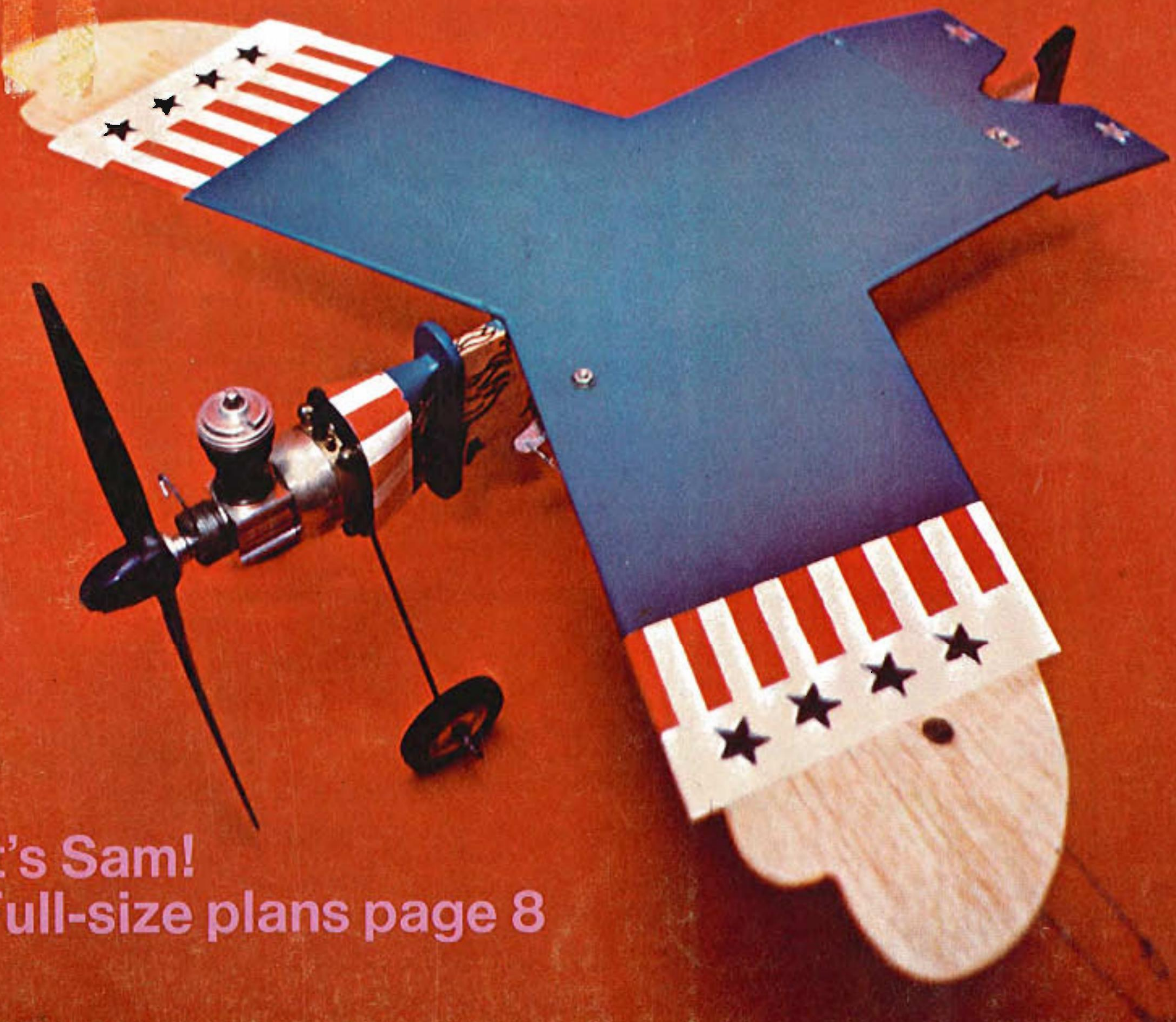

It's Sam!
Full-size plans page 8

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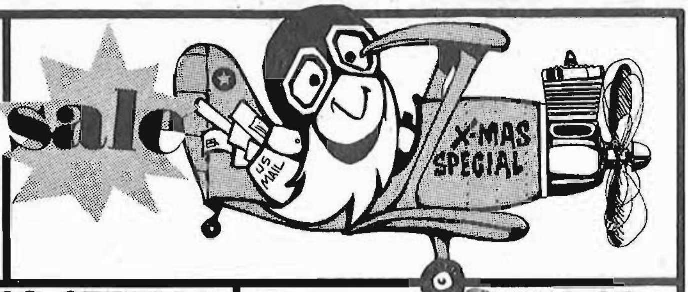

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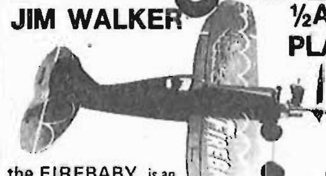

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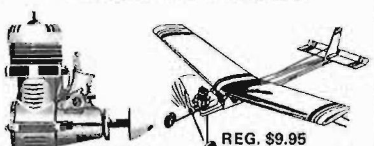

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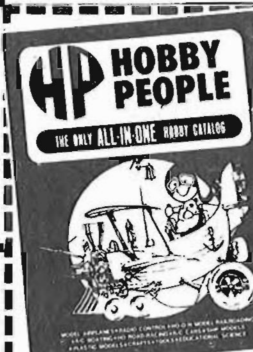

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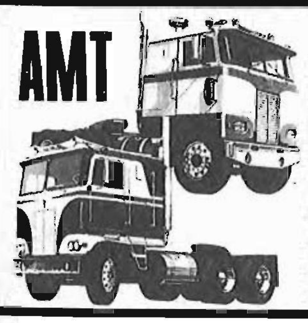

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JR american MODELER

THE HOW-TO-DO-IT MAGAZINE FOR THE BEGINNER AND SPORT FLIER.

VOLUME 1, NUMBER 1 NOVEMBER-DECEMBER 1971

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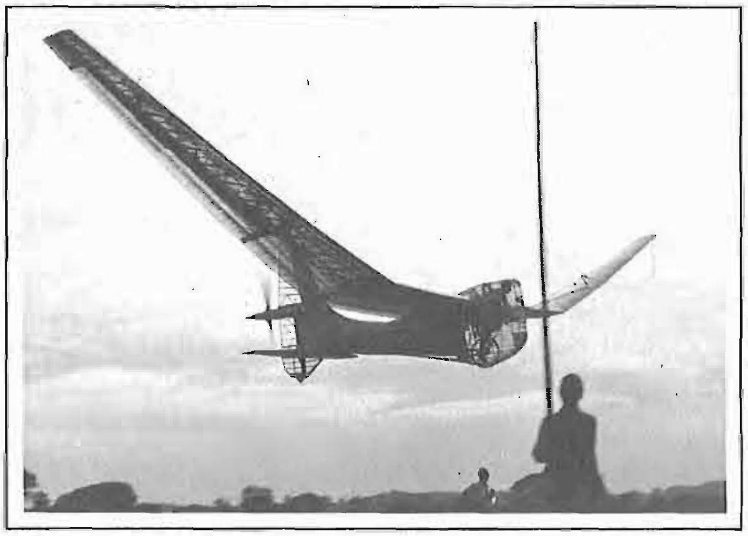
Jam

The strange and wonderful aircraft in the picture below is the "Puffin II". Glanced at it looks like a huge Nordic towline glider coming in for a slow landing. But how about that spinning prop behind the tail? Or perhaps it could be a record-breaking duration radio-control model off to a typically staggering start. But what about the man running beneath it? Or the silhouetted figure in the nose. A man riding a unicycle?

Puffin II is one of the handful of man-powered aircraft which have flown successfully. Oozing by at an altitude of 17 feet in the photo, the lightly-built craft covered 933 yards—about six-tenths of a mile—before its full-throttle pilot-engine ran out of "gas."



The Puffin is a singularly appropriate subject for this first issue of the **JR. American Modeler.** For both the unique airplane and the equally unique new magazine prove that new frontiers remain in this aeronautical world. We may not be able to share the fantastic sensations of Puffin's furiously peddling pilot, but we can share the thrills of the first test hop of a daring publication designed to reach the 10- to 16-year-old beginner, and the fun-sport modeler of all ages. Beginners may be any age—seven to 70!

Puffin, combining concepts and configuration by a process that can only be termed "soaring imagination" proved it can fly. Everybody—modelers, manufacturers, and assorted kibitzers—hopes that a radical magazine like **JR. American Modeler** can fly. We know it will.

The concept, like Puffin's, is a challenge. **"JAM"** will emphasize model airplanes, but will include boats, cars, rockets, kites and educational projects which are fun to build and a pleasure to own. The very finest of designers, writers, and draftsmen, will zero in on imaginative projects, detailed but simple plans, and readable, enjoyable "copy." Where possible plans will be full-size in the magazine, so our enthusiastic readers can begin to build "right now" and without the expense of having to send away for, and purchase, a plan. When the size of the design makes a full-size drawing absolutely impossible, our plan-service will price the plans at cost. The articles and plans will not be cramped for space. Simple, large pictures will distinguish layouts which will consume as many pages as the subject and material may demand.

The keystone of this presentation is a highly developed how-to-do-it treatment—in illustrations, picture features, articles. The models will be fun to build, and more fun to operate. But the basics—the things they don't tell us about—will be, at long last, thoroughly covered. Many contributors even now are working up materials on the bending of wire, working with balsa, covering, and finishing. We will find out how to trim and adjust a free-flight model, to fly towline gliders. To solder. To use sandpaper.

The design and construction of all kinds and types of models will cease to be a mystery. Better plastic models will result as experts show us the techniques of neat and accurate building, and authentic, nifty finishes. The thrills and rewards of radio-control models will be brought within our grasp through simple, inexpensive designs, and control systems. But, be warned, the reader will always have to work, and become a genuine modeler, because all this definitely is not "kid stuff." **JAM** is really filling a need we all feel. It is the *pipeline* between all those experts and idea guys, and those of us who want worthwhile things to do.

How about the configuration? In an airplane, like Puffin, configuration is the shape and arrangement of things—where they put the wing, for example. Or the prop and tail. How it "eyeballs." **JAM**, as you see, is the same size as its Senior companion, **AAM**. It will always be at least 48 pages, probably more. Its cover price is lower than **AAM's** at 60 cents. A six-issue subscription is $3.00. For the first year, it will appear every other month (the publisher, like Puffin's pilot, must not run out of gas!). But with the November 1972 issue it will go monthly. It will not be on the newsstands for some time, but is obtainable at your local hobby shop or by subscription.

Puffin II, if you still wonder, has a 93-foot wing! It weighs 140 pounds empty. The cruising horsepower at four feet altitude is .49. That's less than a hot .60 model engine. But the pilot-engine has the torque to turn a big, biting prop. So does **JAM**!

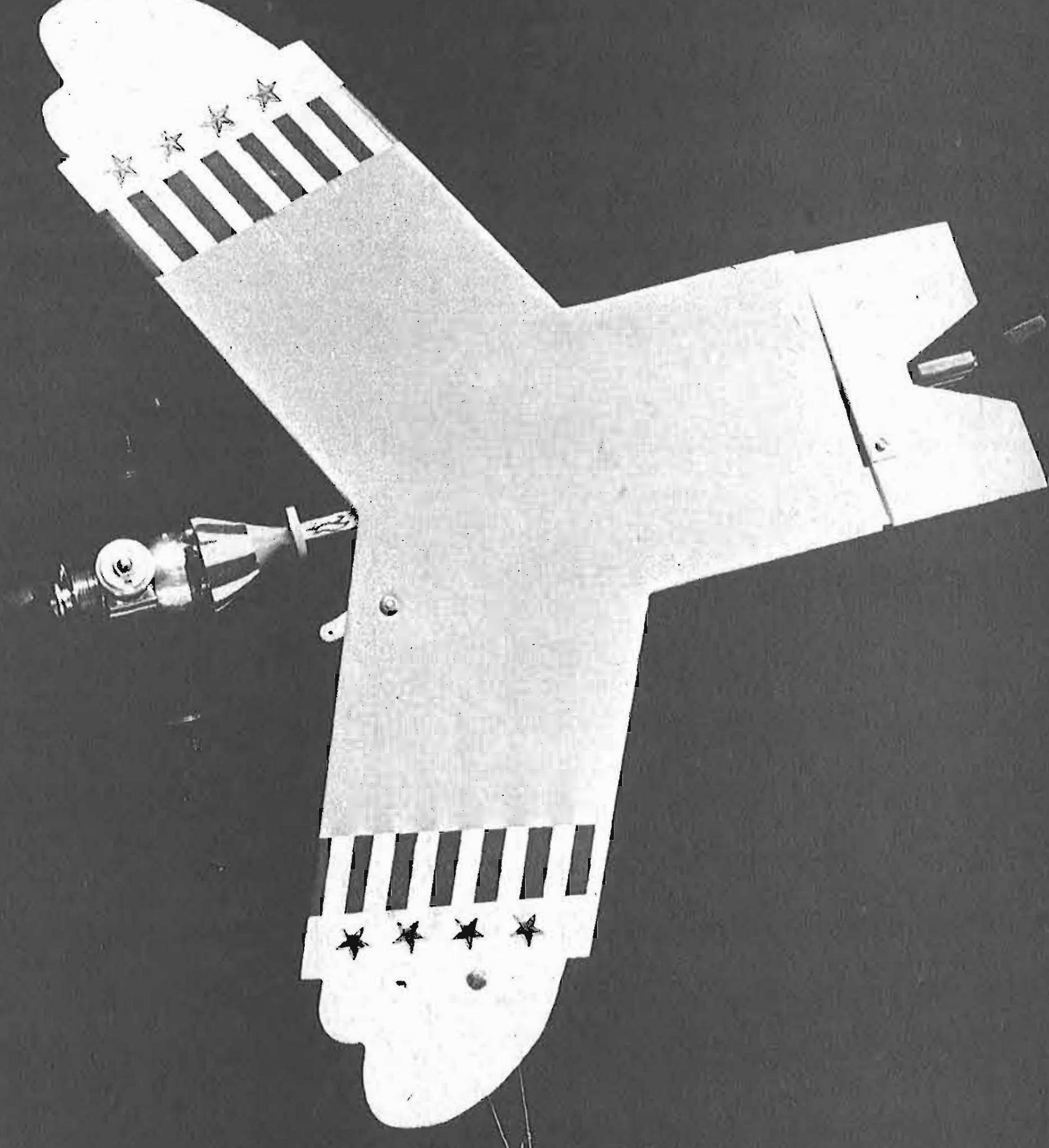
Man-powered aircraft are being tried in a number of countries. Although inventors going back as far as Leonardo da Vinci in the fifteenth century were intrigued by man-powered flight, the first serious undertaking was Alexander Lippisch's ornithopter in 1929. (Wing flapper.) In 1933 Oskar Ursinus, editor of *Flugsport* magazine in Germany, offered a 500-mark prize for a 1 km flight around two pylons 400 meters apart. Haessler and Villinger did fly 790 yards but required a launching assist. In 1936-7 a similar prize was offered in Italy and successful flights were claimed.

Then, in 1959, the Royal Aeronautical Society of Great Britain formed the Man-Powered Aircraft Group. A prize of 5000 pounds was offered that year by Henry Kremer, for a figure-of-eight flight. In 1962 the Aeronautical Society in that country offered a 50-pound prize for a half-mile straight flight. And in 1967 the Kremer Competition increased the prize money to 10,000 pounds. A number of successful flights have been made since then, notably in England and Japan.

We are indebted to Model & Allied Publications, 13/35 Bridge St. Hemel Hempstead, Herts, England, for the photo. M.A.P. is the publisher of *Man Powered Flight*, by Keith Sherwin.

Bill Winter

It's Sam!

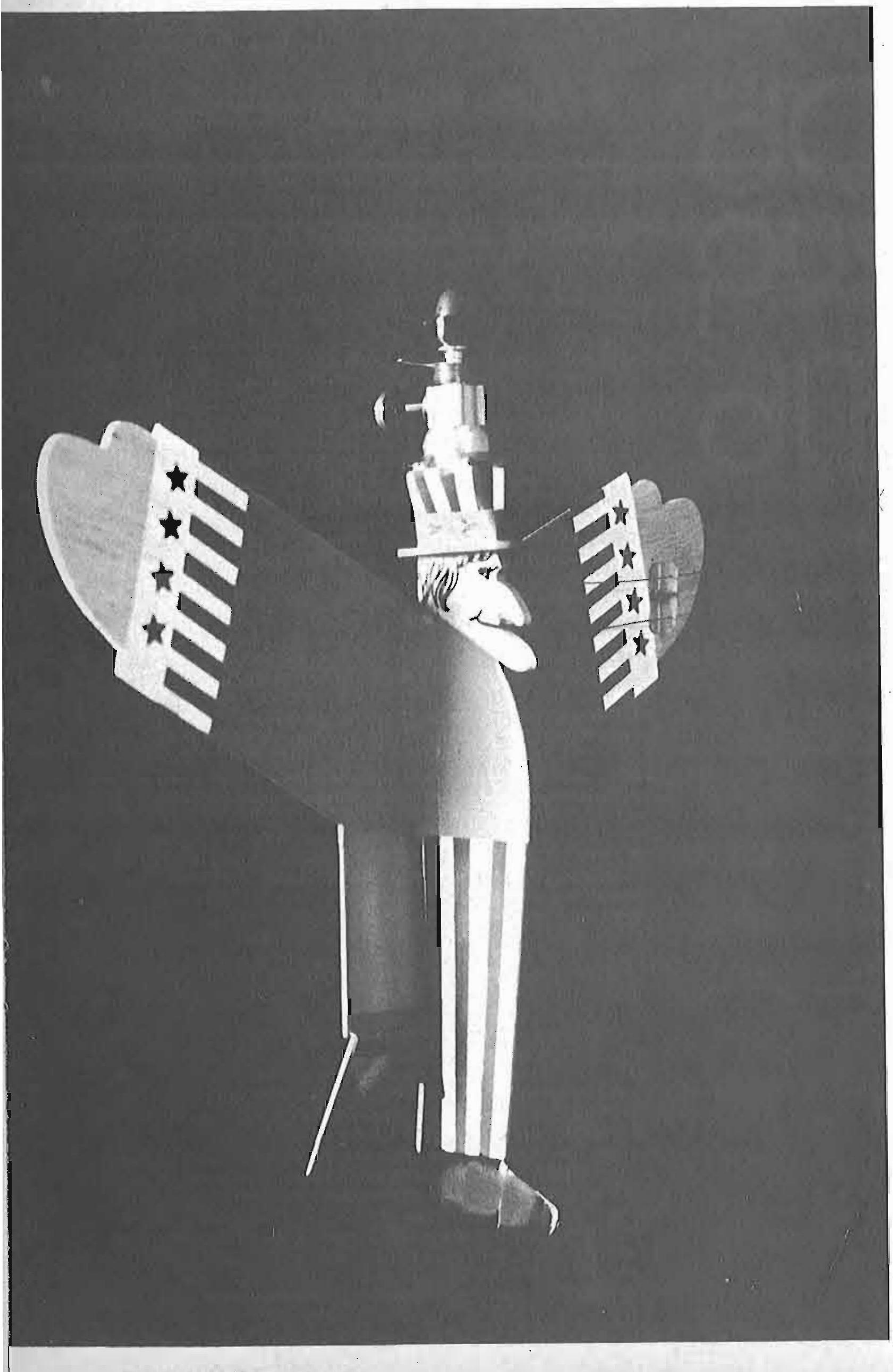


Uncle Sam Wilson, who's he? Well, during the War of 1812, Sam Wilson supplied beef to the United States Army. The barrels that the meat was packed in were stamped "U.S." and some people said that this marking meant Uncle Sam.

Whatever Uncle Sam Wilson, as he was popularly known, looked like is not known to most of us, but cartoonists from the 1830's until the Civil War drew a lanky sort of bearded fellow as Uncle Sam, who, along with his nephew Brother Jonathan, was interchangeable in representing the United States in newspaper cartoons. With the Civil War, Brother Jonathan disappeared and Uncle Sam as we know him sprang from the drawing board of Thomas Nast in the 1870's.

Now since the first airplane was flown in this country it seems unfair that our Uncle Sam should have to remain

by FRANK SCOTT



Oh, Say Can You See! The Stars and Stripes Forever! That's not a space capsule on Uncle's hat, but a Cox .02, set to blast off into groovy circles. He's with it, man. Swept-forward wings are O.K.

earthbound and so, to sort of even things up, we present an Uncle Sam fully capable of flight on his own.

With his striped hat and trousers, and coat of blue emblazoned with stars he will be a splendid addition to any ½A (.049-sized engines) flight line. In spite of his uncommon appearance he will take to the air much like any other model, for, when you get right down to it, he is only a stretched-out flying wing. And very easy to build at that.

Begin construction by cutting out the wing (coat) from a nice warp-free sheet of 1/8"-thick balsa. Then find a table or flat board big enough to lay out the wing parts and cover it with a piece of Saran Wrap to keep the glue from sticking where it doesn't belong. Any sort of white glue, such as Elmer's, or model airplane cement for wood models, will work fine for this project. Next, apply glue to the appropriate edges and assemble the wing. Pin down, or place weights as needed to keep the parts in position while the glue dries, and forget about the wing until the next day or so.

With the assembly of the wing out of the way, trace the outline of the fuselage onto the ¼"-thick sheet balsa. This may be done with carbon paper, or by punching a series of holes around the outline with a pin, and then, after the plan is removed, connecting the pin pricks with a ballpoint pen. You may notice, heh, heh, that this is one fuselage that is truly a "Body." Anyway with the body traced upon the wood, a coping saw or jig saw will be handy to cut out the fuselage. Trace the firewall pattern onto 1/8" plywood, drill the proper holes for mounting your engine, and then saw out the part. Since you may find plywood tough to saw, cut just a little ways outside the desired line and bring it down to finished size with a piece of rough sandpaper wrapped around a small wooden block.

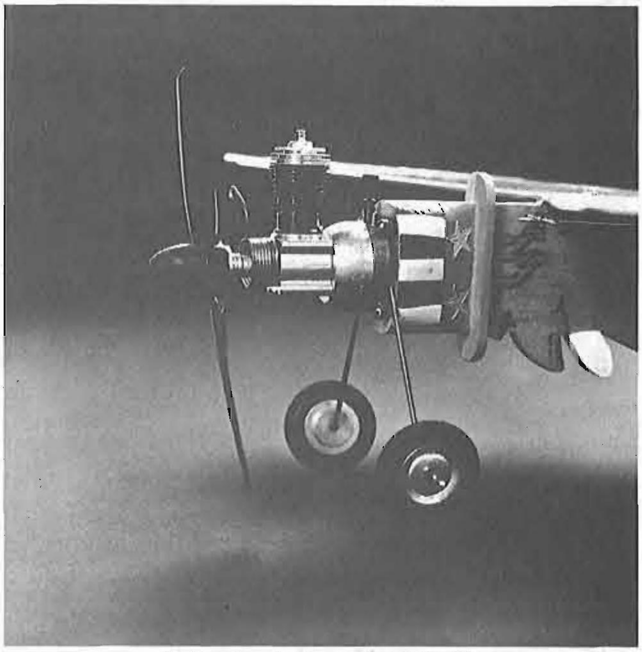
With this done, press the blind mounting nuts (ask your hobby dealer) into holes and the firewall may then be glued into place as the top of Uncle's hat. This assembly will need to be strengthened by adding triangular pieces of wood behind the firewall. This may be done in two ways, either a simple wedge or the stronger blocks made from two layers of scrap fuselage wood which, when dry, can be carved and sanded round to make a better looking hat. Finish the hat by adding the two hat brim halves.

With the front end now in good order we will turn our attention to the other end. Since Sam has no fin and rudder assembly as would a more conventional airplane, we'll have to fake it with his feet (foot!). Carefully cut about halfway through his ankle (ouch!) from the right side, fill the saw cut with glue (that should sting!) and bend the foot about a 3/8" to the right. As would a rudder, this will help turn the model outwards to keep the flying lines tight. About all that is left on the fuselage is to sand it smooth, taking care not to round the corners on top.

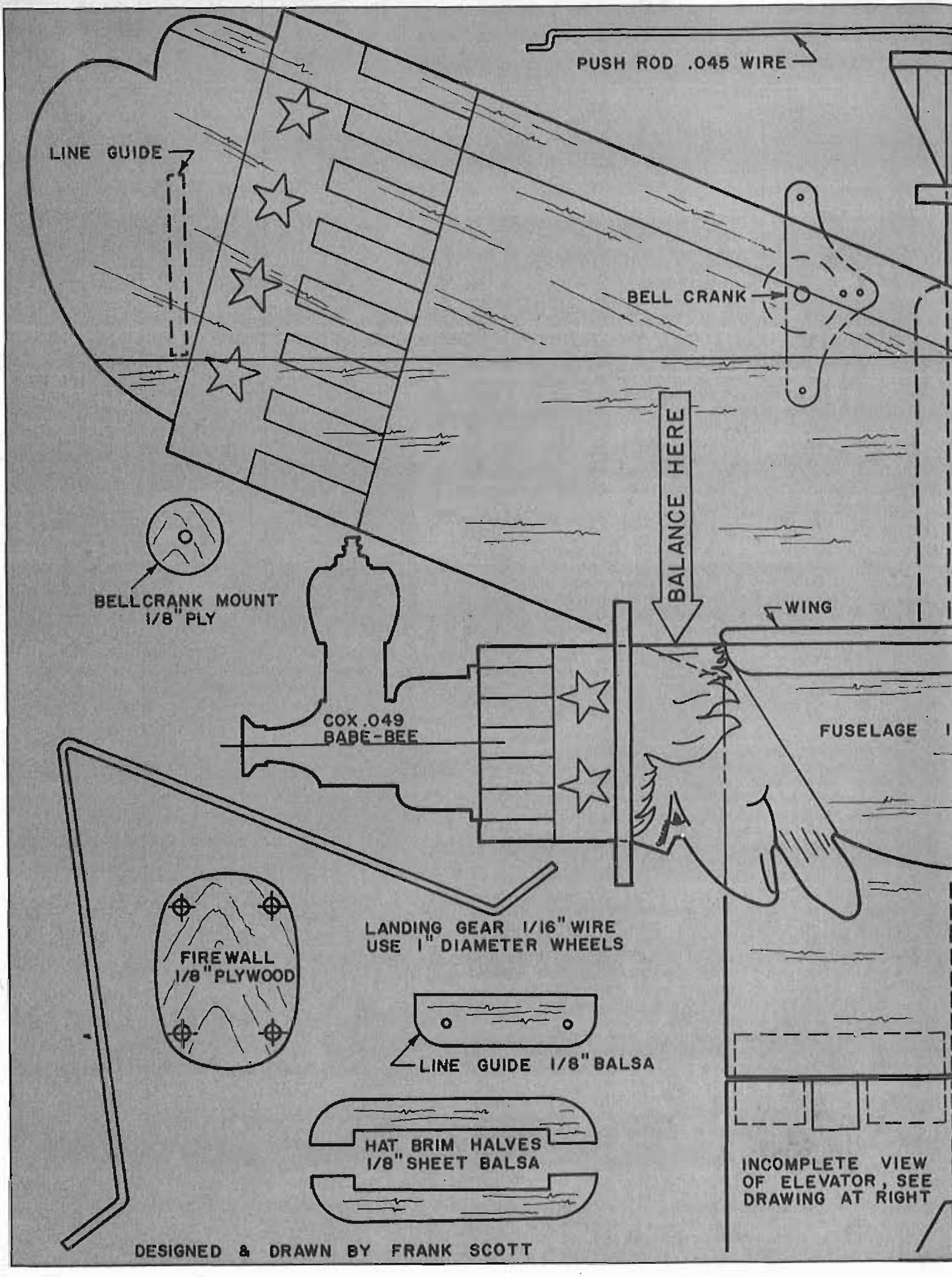
Now that the wing is dry you may find that the glue seams are a bit lumpy. Smooth both sides of the wing with fine sandpaper wrapped around a block and then simply round all edges of the wing with your sandpaper to finish it. On a model of this type there is really very little to be gained in tapering the trailing edges and so forth, and so we won't bother. Cut out the elevators (coattails) and sand them in like manner.

You now may put a layer of glue down Sam's back from his collar to the notch on the top of his legs and carefully locate and pin the wing in place until it is quite dry. Note that the trailing edge of the wing will line up with the front of the notch. This joint may be strengthened with the addition of a strip of wood down each side.

(Continued on page 48)



Optional wheels make takeoffs and landings routine. Without the landing gear, Sam is speedy, but may get his beard trimmed on rough ground. Use helper for hand launching.


PUSH ROD .045 WIRE
LINE GUIDE
BELL CRANK
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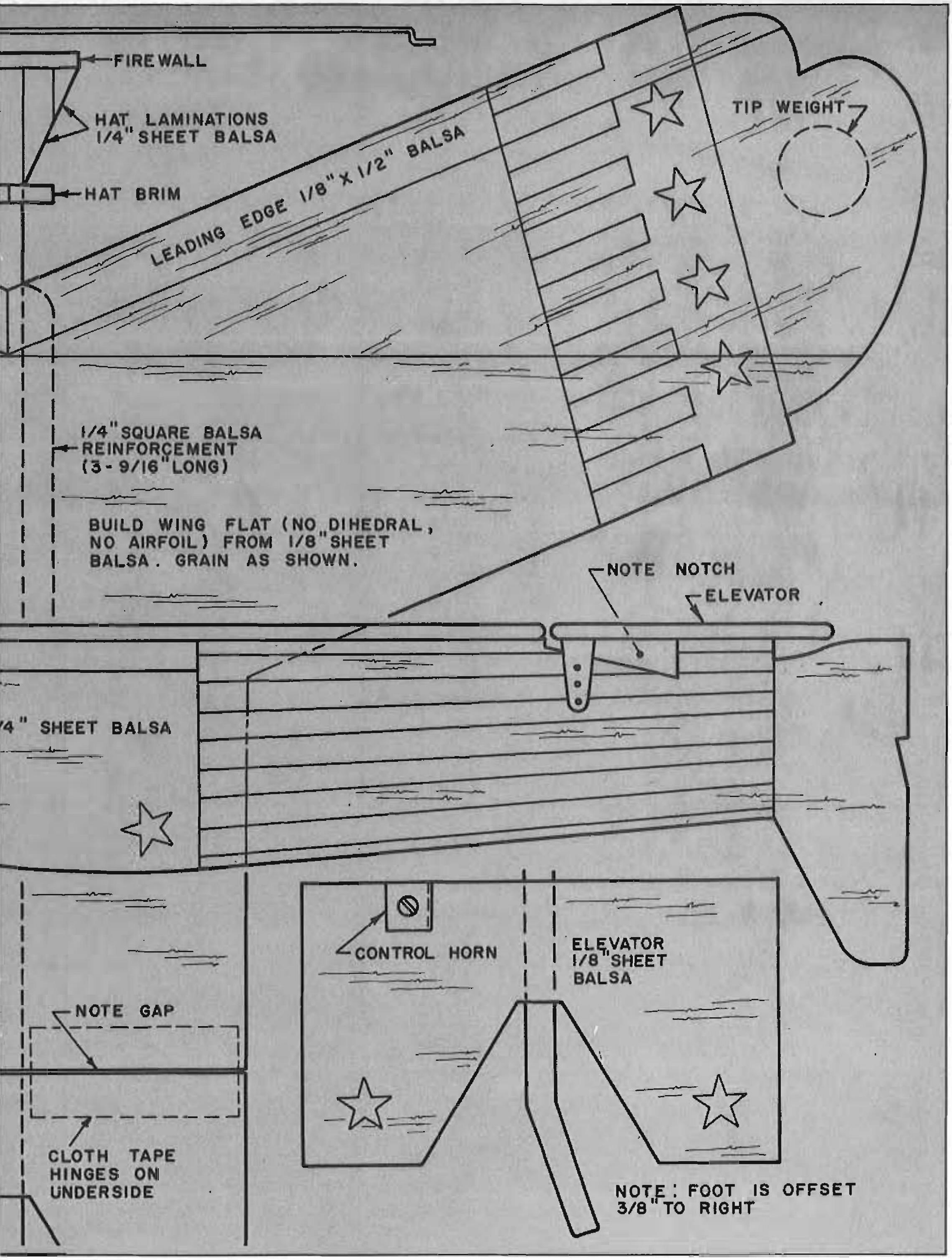
BELLCRANK MOUNT
1/8" PLY
WING
COX .049
BABE-BEE
FUSELAGE
LANDING GEAR 1/16" WIRE
USE 1" DIAMETER WHEELS
FIREWALL
1/8" PLYWOOD
LINE GUIDE 1/8" BALSA
HAT BRIM HALVES
1/8" SHEET BALSA
INCOMPLETE VIEW
OF ELEVATOR, SEE
DRAWING AT RIGHT
DESIGNED & DRAWN BY FRANK SCOTT


FIREWALL
HAT LAMINATIONS 1/4" SHEET BALSA
HAT BRIM
LEADING EDGE 1/8" X 1/2" BALSA
TIP WEIGHT
1/4" SQUARE BALSA REINFORCEMENT (3-9/16" LONG)
BUILD WING FLAT (NO DIHEDRAL, NO AIRFOIL) FROM 1/8" SHEET BALSA. GRAIN AS SHOWN.
NOTE NOTCH
ELEVATOR
/4" SHEET BALSA
CONTROL HORN
ELEVATOR 1/8" SHEET BALSA
NOTE GAP
CLOTH TAPE HINGES ON UNDERSIDE
NOTE: FOOT IS OFFSET 3/8" TO RIGHT


N182X
64
CALIFORNIA AIRMOTIVE
LEAR JET


CALIFORNIA AIRM

PYLON POLISHER

by DON BERLINER

In his days off, he flies around in a purple P-51 with a huge stuffed "Snoopy" riding in the back seat.

Some of the time, he delivers snazzy executive jets to customers in Africa and Europe. Other times, he tests such strange flying machines as the over-stuffed "Guppy" which now carries big hunks of spacecraft to Cape Kennedy.

When duty calls, Clay Lacy takes over as the calm, dependable, serious Captain of a United Air Lines DC-8. Flying airliners must be very relaxing for this busy pilot—except when he pulls a stunt like flying a retired DC-7 in a 1,000-mile pylon race! And actually beating a bunch of Mustangs with it!

No doubt about it, this Clay Lacy likes to fly! And it doesn't seem to make a whole lot of difference what kind of airplane, as long as it isn't like everyone else's.

Lacy spends more time in the roomy, comfortable seat of his DC-8 than he does in his more interesting planes, letting those mysterious little electronic things do most of the work. But he's best known for the brief, wild minutes when he pushes his No. 64 Mustang to its limits, tearing around the aerial race track at Reno, way out in the desert.

Clay was there on that historic day in 1964 when the late Bill Stead did what almost everyone thought was impossible: He brought back the National Air Races. The scene was a first-class dust bowl that used to be an Air Force helicopter training base. It didn't have runways or the other nice things that are needed for a fancy air race. But it did have a bunch of very enthusiastic people who were there to have the first really big air race in 15 years, and that was all that counted.

Lacy was one of the most determined of the bunch of rookies who were ready to show that they were every bit as good as the old-timers that people like to talk about. Roscoe Turner and Steve Wittman and Cook Cleland were great Unlimited pilots in their day, but this was a new day and there was a whole collection of new pilots ready to become heroes.

Only—not everyone was so sure. For one, "Fish" Salmon wasn't sure that these new guys were such hot stuff. And Salmon was something of an expert: not only was he a big test pilot for Lockheed, but he had been a good enough race pilot a few years before to win the Goodyear Trophy with the classic, bronze Cosmic Wind "Minnow." Salmon knew what racing was all about, and he had some doubts about letting a bunch of inexperienced pilots loose on a race course.

If Salmon was worried, then a lot of other people were worried, too. But they had to give the new boys a chance to show how good they were, and Salmon was put in charge of the committee which would watch them do their stuff. Clay Lacy was the first to get a chance to show what he could do, and so a lot was resting on his shoulders.

One of the most important tests was rolling: A pilot had to do a slow roll to the right and then one to the left—without losing altitude. If he could do this, then he should be safe making racing turns close to the ground. Lacy took off and Salmon got on the radio to give him instructions. When it came time to do the slow roll to the right, Lacy roared down right over Salmon's head, in his purple Mustang, and did the prettiest eight-point roll anyone could have done. "Fish" and all the people around him were completely amazed. When Lacy called down over his radio and asked when he should do his roll-to-the-right, Salmon laughed and told him not to bother!

No doubt about it, this new guy Lacy was quite a pilot! And he showed it in the next few days of racing. Even though his Mustang was strictly stock, while some of the others had been souped-up for racing, Clay won enough points to place third, out of five Mustangs and three Bearcats. He didn't set the world on fire, exactly, but he did cause a spark or two.

(Continued on page 46)

an introduction to radio control

SIMPLE, SATISFACTORY SYSTEMS CAN BE PURCHASED FOR ABOUT $85 INCLUDING ENGINE, PLANE KIT, AND ACCESSORIES. IN THE FIRST OF A TWO-PART ARTICLE THE AUTHOR EXPLAINS THE ULTRA-SIMPLE 'PULSE' SYSTEM FOR OPERATING RUDDER AND THROTTLE CONTROLS.

by FRED M. MARKS

If you have been building control-line or rubber-band-powered models or, even non-flying plastic models, the urge to control by radio models that fly realistically will be almost certain. How does one get into radio control? It will be hard to get answers to your questions unless a nearby group of R/C flyers is willing to help you. Since that is unlikely, this article has been written as if questions were being asked by the reader.

What is radio control, and how is an R/C model different from other types of models? Radio control permits any model—cars, boats, trains, airplanes, almost any vehicle imaginable—to be controlled remotely, that is, without the operator having to touch the model once it is started on its way. This is done by transmitting information over a radio wave in the same way as rock music is broadcast over an AM radio. The same things are required: a transmitter to send the information and a receiver to accept and use the information. However, two new things are added: an encoder which performs the same function as a microphone, and an actuator which takes the place of a loudspeaker. The amount of control varies with the complexity of the control system. A simple "pulse" system can give left and right rudder control while a complicated six-channel digital system can permit control of six different control functions—elevators, ailerons, etc.

Radio stations must have a license to operate. How about modelers? Yes, modelers who use radio control must be licensed, with one exception. Some transmitters are designed to have less than 100 milliwatts or 0.1 Watt output (you are familiar with the term "Watt" from the ratings which appear on household electric "bulbs") and may be operated without a license in the frequency band from 26.97 Megahertz (MHz) to 27.27 Megahertz provided they do not interfere with any licensed equipment. (One Hertz equals a frequency of one cycle per second. A Megahertz is one million cycles per second.) These are suitable for many models, but should not be used for model planes, due to short radio range. There are now two bands of frequencies available to modelers which require a license. This license may be obtained without taking any examination. These frequencies are: 26.995, 27.045, 27.095, 27.145, and 27.195 MHz (in the 27 MHz band) and 72.08, 72.24, 72.40, 72.96, and 75.64 MHz (in the 72 MHz Band). Do not buy or operate equipment on other than the above frequencies unless you have the proper license. The proper license for these frequencies is the Citizens Band license for Class C. This license may be obtained in two ways at present. The most common way is by personal application. The proper application form may be obtained by writing to the Federal Communications Commission at Washington, D. C. 20554. Ask for Form 505. The license is for five years and costs $20. The completed application

must be sent to the Federal Communications Commission, Gettysburg, Pa. 17325. Certain R/C clubs have taken action to obtain a corporate license whereby the club pays the $20, obtains a license covering all its members and assumes the responsibility for the members' transmitters. This saves the individual modeler the $20, but each member must be absolutely sure to abide by the F. C. C. regulations or risk the loss of the club license.

What is the best way to get into Radio Control? There is no one best way, for every modeler's interests are different, as are his enthusiasm, finances, and determination. The answer must reflect the viewpoint and needs of the modeler asking the question. The safest way is to start with the simplest, most inexpensive system, and with a boat or car; then, as experience is gained, to progress to a simple, inexpensive plane. However, if one has already flown airplanes very much, the concept of trying a simple ground machine may lack appeal. Then the best way is the one least likely to result in loss of an airplane and equipment. (Later in this article we will present a system and an airplane designed to meet these requirements.)

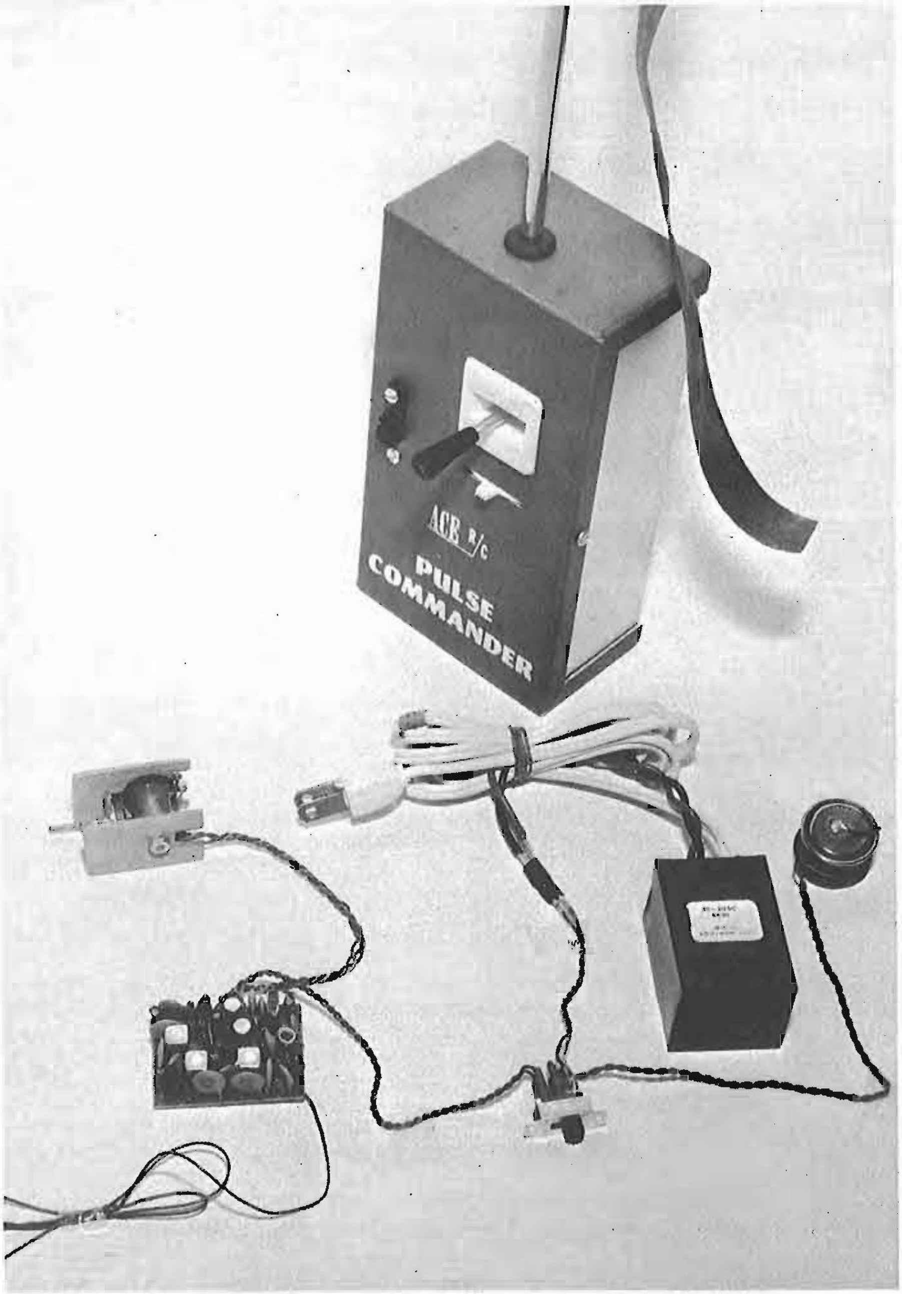


Fig. 1. L to R: Actuator, receiver, transmitter, battery charger and nicad batteries.

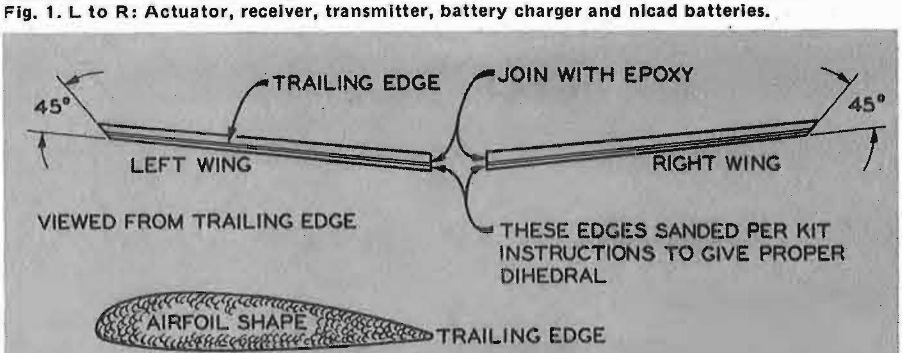


FIG. 2 WING ORIENTATION

We read about so many of the different kinds of systems in the model magazines; which is the best? The best for you depends on your finances and interests. My recommendation for the fellow who has enough money is to purchase a digital system that will satisfy future needs as well, but to start out with a simple, inexpensive airplane which uses only one or two of the channels for control. Thus, it may be more practical to buy only one or two servos. Some of the small easily built models, such as the Goldberg Junior Falcon, Sterling Minnie Mambo, Midwest Lil Esquire, fly quite well when using only two channels of a small digital set. These models have a big plus in that the small 049 engine they use will fly all afternoon on less than a pint of fuel. This is quite a contrast to a 60-engine-powered monster "big guys" fly, that consumes almost a pint of expensive fuel on every flight!

For the fellow who is a bit cramped for funds, two routes may be followed. The ACE pulse system to be described later is one example. The second example costs about the same, but is a single-channel digital system sold by Controlaire as the Digit Migit. This particular rig has the advantage that it may later be traded in for more advanced equipment. It will require a slightly larger airplane to carry the set, but 049-powered models listed above will suffice.

How do I learn to fly without smashing the R/C plane? If you have learned to use the equipment in a car or boat, some of the problems will be solved. One of the first such problems is

the sudden realization that, when the model is heading toward you, the controls are reversed. When this happens the airplane/car/boat turns the opposite direction from what was expected. Being able to get the model trimmed and balanced to fly, and the above problem, are the two most difficult hurdles for the raw beginner. The best way to learn is to have a more experienced flyer teach you by first flying and properly trimming your model—if such a modeler is located nearby. It may help to obtain the roster of clubs from the AMA (Academy of Model Aeronautics, 806 Fifteenth St. N.W., Washington, D. C. 20005). Incidentally, if you aren't already a member, it is wise to join the AMA so that your model flying activities will be properly covered by insurance.

If it is impossible to get help in learning to fly or trim your model, then you must test fly it yourself. But first, write to ACE Radio Control, Higginsville, Missouri 64037 and ask for a copy of an article titled "Pulse Rudder-Only Flying Techniques." While it says "Pulse Rudder," this timely set of instructions is quite appropriate to flying any of the smaller R/C models which are operated on rudder-only control. (In a later issue, we will provide detailed instructions on adjusting and flying.)

Hey mister, how much does that thing cost? The cost for getting started with the least expensive combination of radio, airplane, engine, and accessories will be about $85. Not all this has to be spent at once. The airplane kit can be bought for about $6. An engine will cost another $7.50. With glue, dope, fuel, wheel, and a starting battery, the total airplane, without the radio, will be about $16. The radio is the big cost item. The ACE pulse system or the Digit Migit cost $69. (Yes, there are cheaper ways of getting into R/C, such as using escapements but I can't really recommend them unless there is someone to land a hand.)

Hey, there are still lots of questions you didn't answer! Right, but there will be more coming next issue. (Meanwhile, the basics can be learned by ordering a book for $1.00, Getting Started in R/C, from Potomac Aviation Publications, Inc., 733 15th Street, N.W., Washington, D.C. 20005.) For now, let us discuss the pulse system. To avoid confusion, the way that pulse works won't be described just yet. Take our word for it, it works. The system used for example was designed specifically for simple, inexpensive flying: the ACE Pulse Commander. This system consists of a transmitter with the pulser (the encoder mentioned earlier) built in, a receiver, a magnetic actuator, and nickel cadmium batteries. (See Fig. 1.)

The airplane we chose for this discussion is called "Dick's Dream." It is available from the local hobby shop or from ACE Radio Control. This is a tiny

Fig. 3. Extras required include dope, thinner, glue, cement, balsa knife, rubber bands.

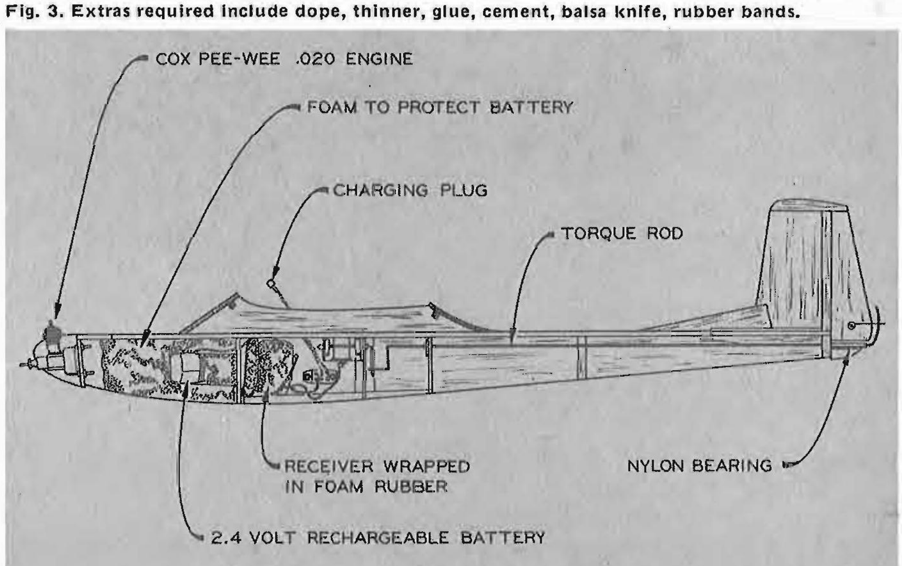


FIG. 4

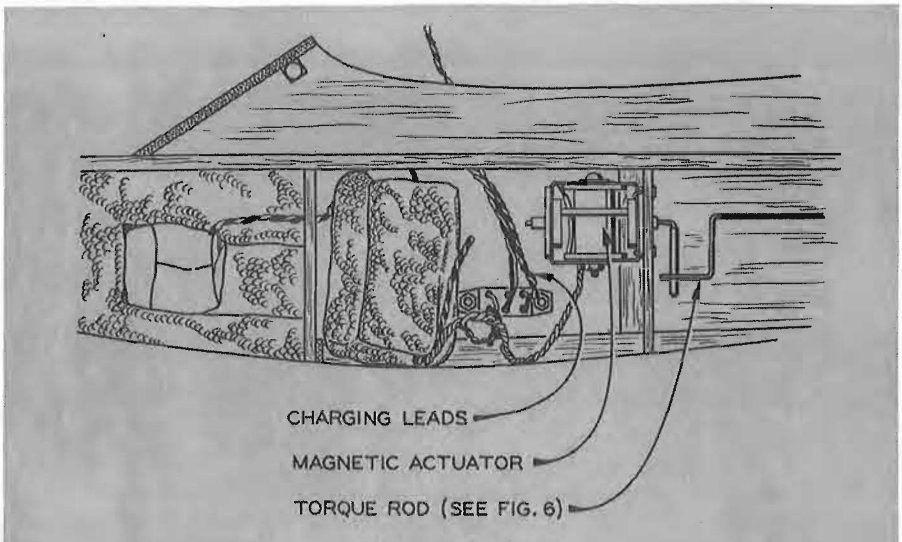


FIG. 5

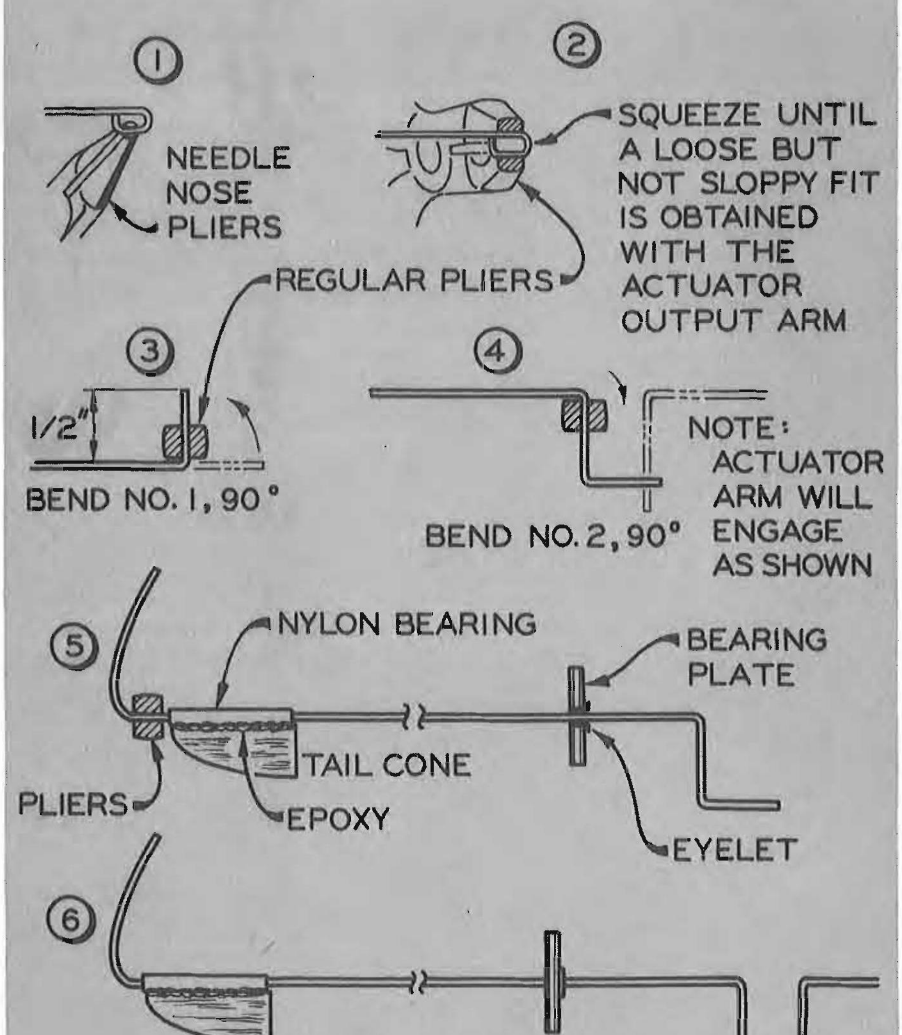


FIG. 6 BENDING THE TORQUE ROD

model designed specifically for the small pulse rigs. It is ideal for the beginner because a tiny model is almost impossible to damage if flown over moderately deep grass such as a pasture. Flying a model over meadows is not recommended because it can easily be lost in tall grass, wheat, etc. Don't scoff! A favorite model of mine, almost five feet in span, required an hour to find, and it was known to be in an area about 100 feet square. Searchers passed within four feet without seeing it nestled deep in the wheat, even though the model was bright red!

As it arrives in the box, the model kit consists of a set of shaped styrofoam wings, and balsa and plywood parts for the fuselage and tail assembly. Note that both wing panels are exactly alike, and remember constantly as work is done on them that one must be made a right hand wing and one a left. The plans and instructions provided are extremely clear, but it is easy to forget. Consult the simple diagram in Fig. 2.

Before the diecut balsa parts are pushed from the balsa sheets, they should be carefully identified from the drawings on the plans and marked with a pencil, because they have no identification numbers printed on them. There are certain tools and materials that will be needed before starting. An X-Acto knife is nice, but a single-edge razor blade will do. Model cement, such as Pactra, Testors, or Ambroid will be needed. Do not use plastic cements intended for assembly of plastic models. Contact cement such as Weldwood is most useful for fastening doublers (a doubler is an extra thickness of material) to the fuselage, but model cement will do.

This next item will cost another dollar but can be used for many models: Devcon or Hobbypoxy five-minute epoxy in tubes. Use the epoxy to join the wing halves, to mount the firewall and landing gear, and to coat the entire engine compartment for protection against fuel. Clear dope with talcum powder mixed in makes a good filler for the wood surfaces prior to color painting. (Use one part talc to five parts clear dope.)

Follow the painting instructions provided with the model. Don't use any cement on the foam wings except epoxy or white glue. Other cements or glues will melt the foam and ruin the wings. Some of the things mentioned may not be familiar, therefore, we assembled the parts mentioned. Fig. 3 shows what should be brought home with the kit in order to put it together. This photo is not an endorsement for particular brands, and merely illustrates the things to look for at the hobby shop.

If it is assumed that the R/C beginner has some experience in building models, then the most difficult task is that of properly installing the equipment. To help you with this, the right half of Dick's Dream was built and the equipment installed. Fig. 4 shows the overall installation with all items identified. It shows where the equipment should be positioned, where foam rubber is required for protection, and

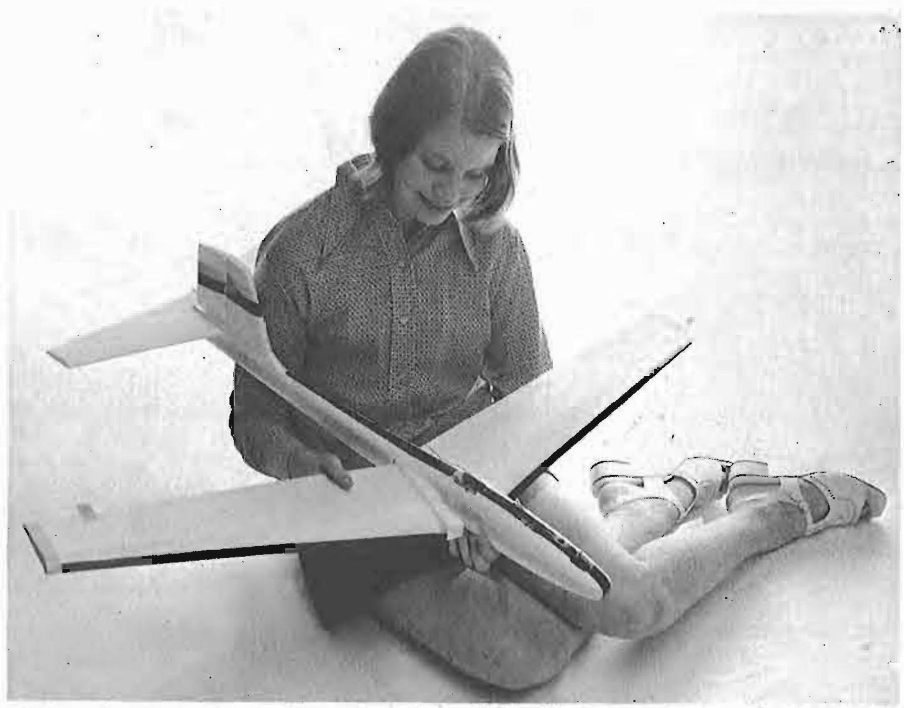
The magnetic actuator which moves the rudder by means of wire torque rod (not shown). Two plywood pieces are for mounting purposes.

the torque-rod connects actuator or servo with the rudder. Fig. 5 is a close-up of the equipment compartment showing the routing for wires.

Some notes on these figures will help avoid problems. Starting from the front, the battery pa k must sit in a pocket in the foam rubber as shown. This foam is best installed before the fuselage bottom is put in place. The receiver must be wrapped in foam rubber, at least 3/8 inch thick, and placed with the bottom of the printed circuit board of the receiver toward the forward bulkhead. Tie a knot in the receiver antenna 2-1/2 inches from the receiver before inserting the antenna through a 1/16-inch hole drilled in the fuselage side. Be sure to place large washers under the screw heads which hold the switch in place on the outside of the fuselage. Although not shown on the plans, the precaution was taken of adding wood rails crosswise to the bottom of the cabin to hold the actuator bulkhead more firmly. Also, the actuator bulkhead is free to move up and down and should be restrained by spot cementing at the top on each side. Don't glue the whole assembly in place because it is convenient to be able to remove the switch and slide everything out to use in another model.

The torque rod may be a little difficult to bend and this actual operation isn't shown in the instructions. Fig. 6 is provided to show how the bending is done. The actuator arm actually holds the front loop where it belongs, so, in performing step 5, carefully check the location for the bend at the tail with the arm engaging the torque rod. Then disengage the actuator arm and slip the torque rod back, so that the bend can be made to come out exactly at the rear end of the nylon bearing when the actuator arm is engaged, as shown in step 6. Solder or crimp an eyelet to the pushrod where it will contact the nylon bearing to prevent it's ramming forward in a collision. Note also, that the centerline of the actuator arm and the torque rod should align as nearly as possible.

Don't be alarmed if it seems that the preceding is not enough to build a model. The instructions provided with the model are very clear and this information is to help surmount a couple of rough spots for the beginner who hasn't built an R/C model before.



This toy styrofoam glider by Eldron Industries with plug-in wings and tail is easily converted to radio control by cutting holes in forward body for batteries and system.


AMA

FLIP and FLOP

The hand—launched glider probably is the most popular of all forms of model aircraft. Simple to build and fly, the "HLG" brings much enjoyment to the hobby. A good model can be built in as little as a couple of hours, and should not require more than a day or evening if you work slowly. That really depends on how long it takes the cement to dry. Once you have mastered the technique of throwing your glider you will obtain many fine, long flights—and it is quite possible you will know the excitement of catching a thermal (rising warm air current) which could carry the craft out of sight. So be sure to put on it your name, address, and phone number.

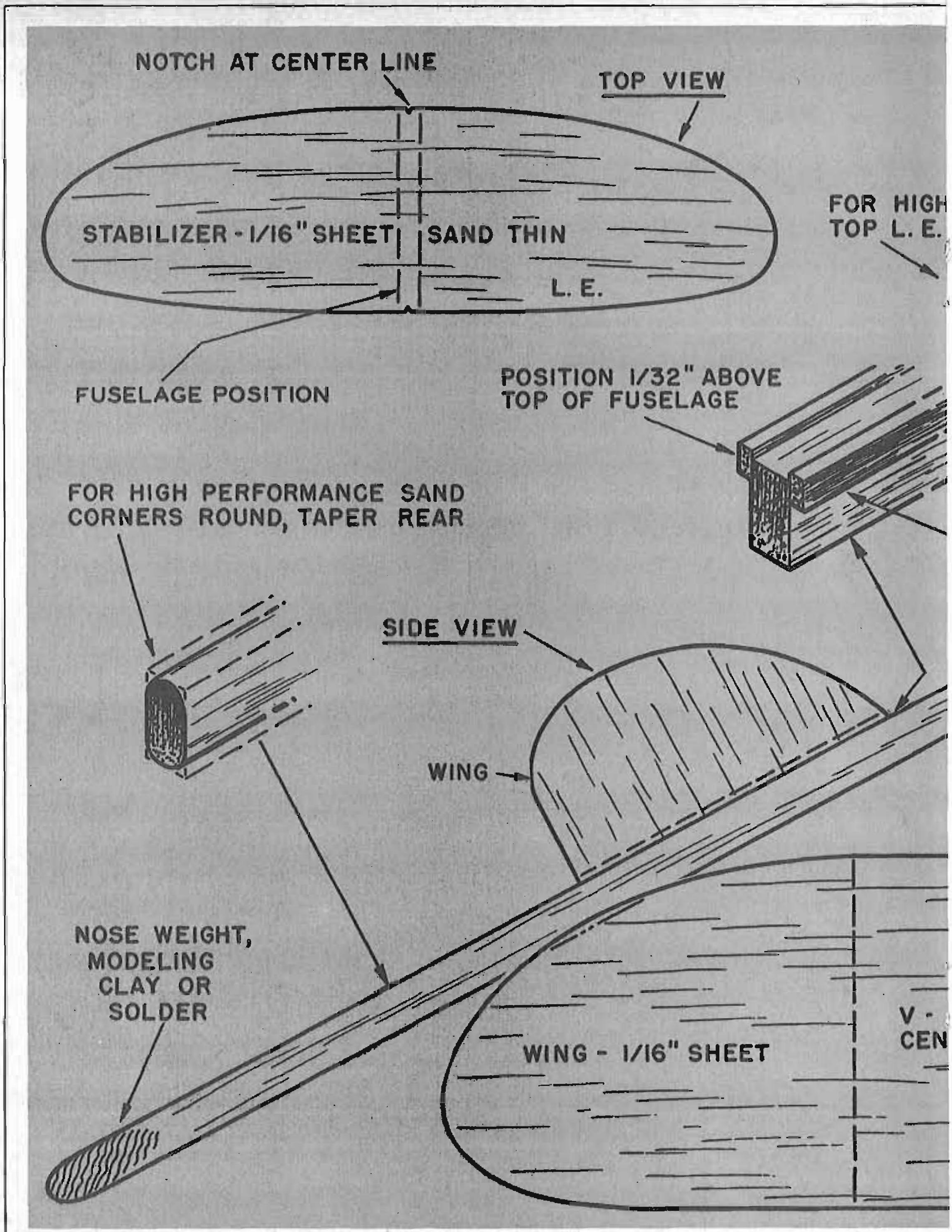
The two models shown here (see full-size plan on the following pages) were created by the late Cal Smith, an internationally famous designer of all forms of model aircraft. The difference between the two lies in the wing dihedral. One model has the dihedral-angle break at the center of the wing, the other has a flat center section with both tips angled upward. Dihedral is always necessary in free-flying models to provide the necessary stability, or ability to fly without crashing in a descending spiral to the ground. Stable models return to a correct flying position whenever acted upon by some upsetting condition, such as a gust of wind.

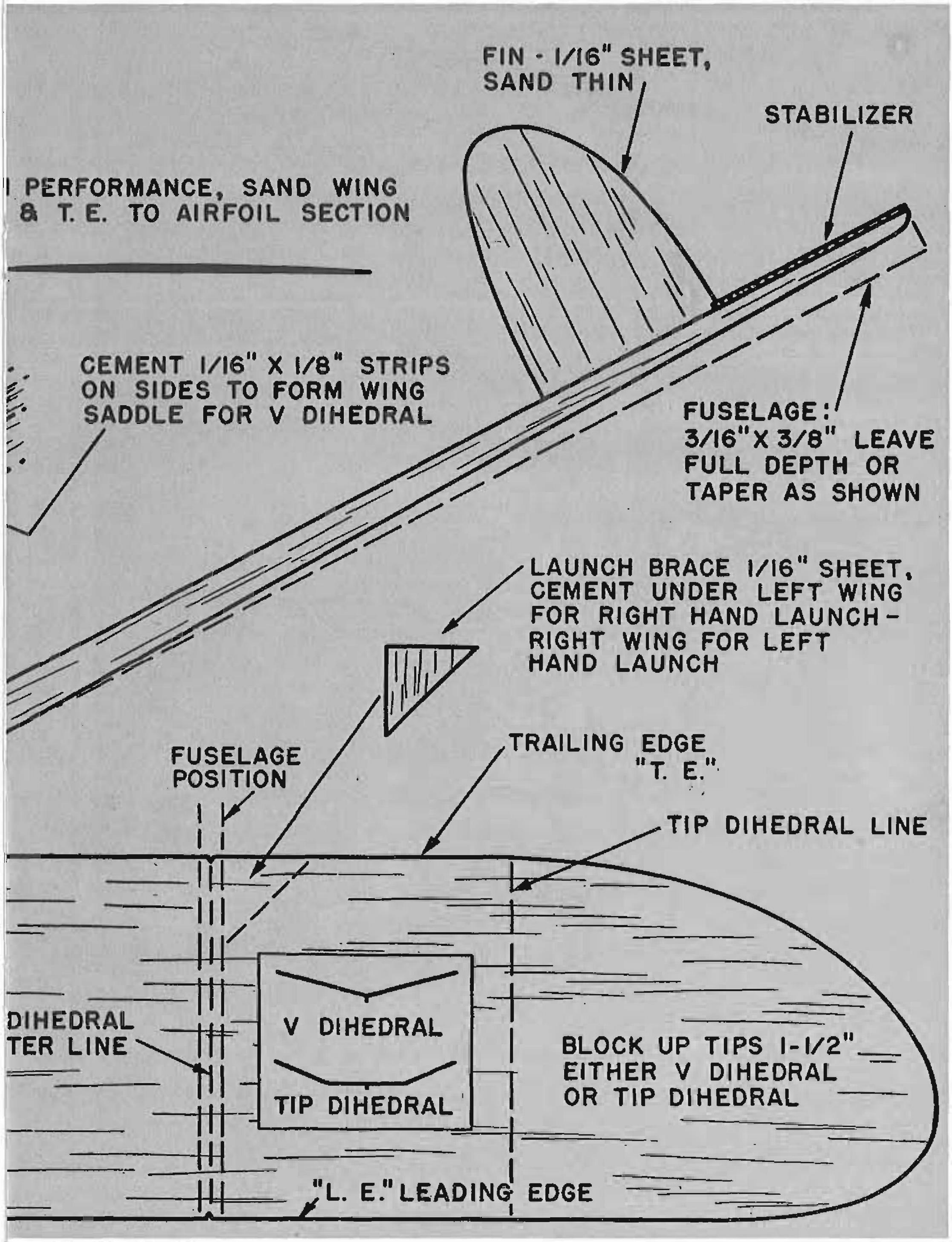
Although "Flip" and "Flop" are simple models to build, they are rather lightly built for their size in order to increase their duration of flight to a maximum. The instructions and material sizes are printed conveniently on the plans. On the page at the right will be found tips on tools and assembly procedures, as well as flying instructions. So let's discuss possible points of difficulty in cutting out and working up your materials.

Note that the fuselage (body) is a 3/16 x 3/8" strip. This strip should be medium hard balsa for strength. If you have difficulty obtaining this size wood, cement together two pieces of 3/16" sq. Use a few pins to hold the strips together until dry, or wrap them tightly with rubber bands which can be pulled away afterwards.

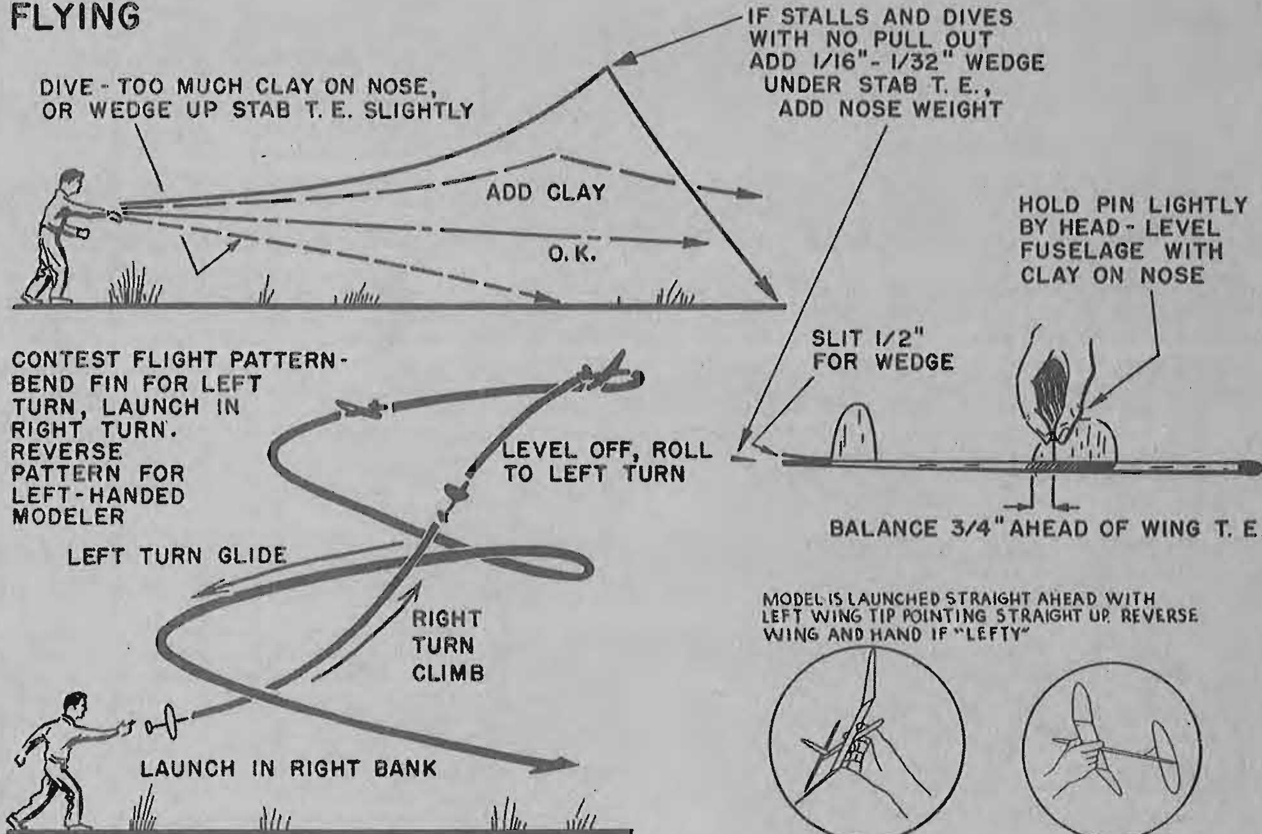
The wing is only 1/16" thick. Actually, you can substitute soft 3/32" sheet balsa if you wish without too much of a flight penalty. Lightly sand off any wood fuzz. It is enough to gently round off the leading and trailing edges on the 1/16" sheet. A super job results from sanding the wing to the cross section shown on the plan. This is hard to do with 1/16" sheet, not so hard with 3/32". The tail must be 1/16" sheet because models easily become "tail heavy." It is advisable to taper the body stick as suggested. Not to do so will require more nose weight for balancing, and less duration of flight.

A good glider really ought to be well finished. Mix about one ounce of clear dope with four or five drops of castor oil and enough talcum power to make a very thin cream-like substance. Before the wing and tail are glued in position, paint on a thin coat of your special finisher. After it dries, sand it lightly with very fine sandpaper, and then put on another coat. Bare wood creates extra skin friction or air drag. The smooth finish allows the model to slide through the air more easily. Do not paint the model—minimum weight is important. You can trim it with a touch or two of colored dope, or apply colorful decals obtained from your hobby shop. Have fun!


NOTCH AT CENTER LINE
TOP VIEW
STABILIZER - 1/16" SHEET
SAND THIN
L. E.
FUSELAGE POSITION
FOR HIGH
TOP L. E.
POSITION 1/32" ABOVE
TOP OF FUSELAGE
FOR HIGH PERFORMANCE SAND
CORNERS ROUND, TAPER REAR
SIDE VIEW
WING
NOSE WEIGHT,
MODELING
CLAY OR
SOLDER
WING - 1/16" SHEET
CEN

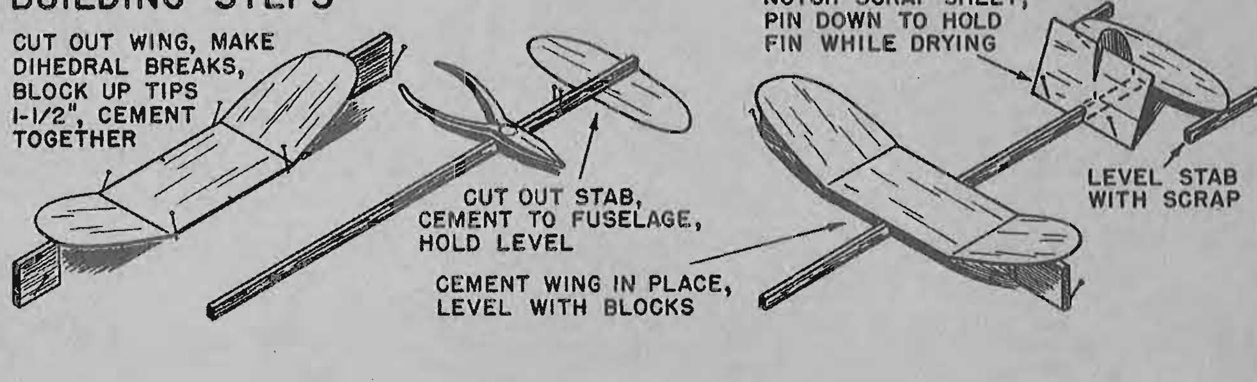

FIN - 1/16" SHEET, SAND THIN
STABILIZER
PERFORMANCE, SAND WING
& T. E. TO AIRFOIL SECTION
CEMENT 1/16" X 1/8" STRIPS ON SIDES TO FORM WING SADDLE FOR V DIHEDRAL
FUSELAGE: 3/16" X 3/8" LEAVE FULL DEPTH OR TAPER AS SHOWN
LAUNCH BRACE 1/16" SHEET, CEMENT UNDER LEFT WING FOR RIGHT HAND LAUNCH - RIGHT WING FOR LEFT HAND LAUNCH
FUSELAGE POSITION
TRAILING EDGE "T. E."
TIP DIHEDRAL LINE
V DIHEDRAL
TIP DIHEDRAL
DIHEDRAL
TER LINE
BLOCK UP TIPS 1-1/2" EITHER V DIHEDRAL OR TIP DIHEDRAL
"L. E." LEADING EDGE

FLYING



SUPPLIES & TOOLS

BUILDING STEPS



A BEGINNING IN MODEL ROCKETRY

by FRANK GENTY

In October 4, 1957, the Russians placed in orbit a shiny metal sphere 23 inches in diameter and weighing 284 pounds. This was Sputnik I, the world's first man-made satellite—and the launching paved the way for what is today the fastest growing hobby in the United States and in many foreign countries: Model rocketry.

Safe, exciting, scientific, and limited only by man's imagination, this is a hobby enjoyed by over one million Americans and it is still growing at a fast pace. An ideal father-and-son recreational activity, it also owes its spectacular success to the fact that it is relatively inexpensive.

"Great!" you'll say. "But what is model rocketry?" Well, simply stated, it is the science of miniature astronautics. Except for the vastly reduced sizes, it faithfully duplicates what is happening at Cape Kennedy when one of the big "birds" is launched.

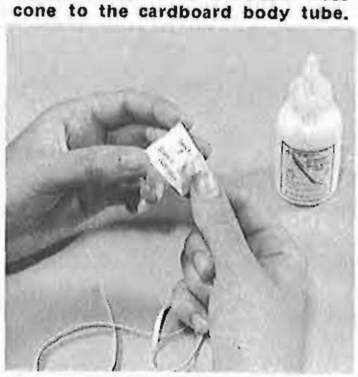
The basic model rocket, which may vary in length from about five inches to nearly four feet, consists of a nose cone—made of balsa wood or plastic; a launch lug (which slips over the launch rod to guide the flight); a recovery system (parachute or streamer); and an engine (which is discarded after each flight).

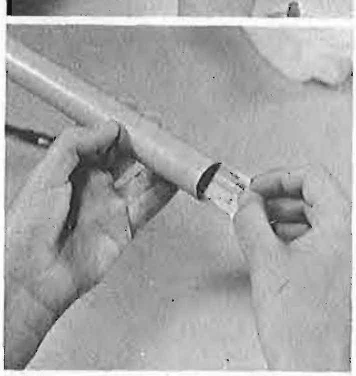
Model rockets are usually sold in kit form, but rocketeers often prefer to design their own models and buy individual parts. Regulations limit the weight of the rocket to 453 grams (16 oz.) at liftoff, and the model must have a true and predictable flight path.

To launch his bird, the rocketeer uses a pre-manufactured, solid-propellant engine which is electrically ignited. And this is where model rocketry differs from most other recreational activities in that it is absolutely safe—much safer in fact than bicycling, football, baseball, swimming, horseback riding, and similar outdoor forms of relaxation and fun involving youngsters between the ages of 8 and 16. Over 24-million successful model rocket launches are proof enough of the built-in safety features of model rocketry.

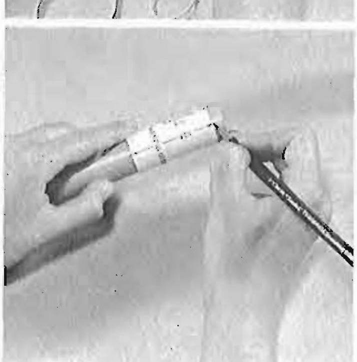
Building engine holder. Adapter rings center engine in the body tube. The wire retains engine.

Gluing shock cord to mount. This elastic shock cord connects nose cone to the cardboard body tube.





The shock cord mount is placed in the body tube and glued. Parachute also connects to nose cone.



Tracing the line pattern for the fin position, launching lug, etc. Marking guide comes in the kit.

Youth rocketry was not always that safe, however, and one shudders at the thought of the "dangerous years" when space-oriented youngsters—their imagination fired up by the Sputnik I breakthrough and subsequent U.S. and Russian achievements—endangered themselves, their relatives, their friends, and their neighbors by concocting exotic, and highly unstable, rocket fuels.

In those early years when a newspaper told about a young rocket experimenter, it was usually a tragic story—like the boy in California who loaded a metal pipe with match heads which exploded, killing him instantly and crippling his friend for life—or the teacher who was killed, and seven of his students injured, when he filled an improvised rocket with explosive chemicals. Still another case involved a young man who lost an eye as he was placing hazardous chemicals in a CO_2 cartridge.

These were the days of the "basement bombers," and the Institute of Aeronautics and Astronautics estimated that each of these experimenters had a one-in-seven chance of being seriously injured, or killed, for each year he continued to gamble with home-brewed fuels.

Then, in 1958, a significant event occurred that was destined to practically eliminate the "basement bomber" and his dangerous practices, and make youth rocketry a perfectly safe hobby. It was the advent of the mass-produced model rocket engine, the brainchild of Vernon Estes, then a resident of Denver, Colorado.

Deeply concerned with the well-being of the thousands of youngsters who had caught "space age fever" and were in danger of paying a high price for it, Estes, an expert in the electrical engineering field, went to work designing and building a machine that would turn out model rocket engines safely and automatically.

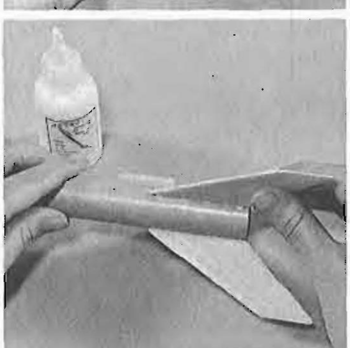
The result was "Mabel," a prima donna who, when happy, made and inspected one model rocket engine every 5½ seconds. It was instant success, and the rest is history. Vern Estes branched out into model rocket production, moved his business to Penrose, Colorado, and today is President of Estes Industries, a subsidiary of Damon Corporation and the world's largest manufacturer of model rockets and supplies.

Safe to handle and safe to use, the basic model rocket engine that propelled Vern Estes to fame, so to speak, conforms to the Solid Propellant Model Rocketry Safety Code, which has been approved by the National Association of Rocketry and the Hobby Industry Association of America. For one thing, a model rocket engine cannot contain more than 113 grams (4 oz.) of propellant.

No matter what their thrust capabilities, model rocket engines have the same basic construction. The casing is made of tightly wound paper which houses the following components:

Paper pattern, metal rule, balsa knife, are used to cut the fins from sheet balsa. Must be true.

Gluing the engine holder into the cardboard body tube. Metal retainer for the engine shows clearly.



Gluing on the fins. Also visible is the launch lug which slides on metal launch rod for lift-off.

Gluing screw-eye to nose cone. Both the elastic shock cord and parachute cord attach to this eye.

(1) A ceramic nozzle which allows exhaust gases to escape during flight, producing thrust.

(2) A high-thrust charge for liftoff and acceleration. This charge is made of solid fuel mixed with an oxidizer which provides the oxygen needed for the fuel to burn in the atmosphere.

(3) A non-thrust delay and smoke tracking charge which enables the rocketeer to follow his bird's flight.

(4) An ejection charge for the deployment of the recovery system.

(5) A retrainer cap made of clay, to hold the components.

Model rocket engines vary in sizes and/or propellant content to produce the total impulse (total power) needed to attain maximum altitude. For instance, taking an 0.8 oz. Estes Alpha model rocket as a test vehicle, a 1/2 A6-2 engine will lift the bird to about 110 feet. Change that to an A8-3, and the rocket will reach 350 feet. Now try a B6-4, and watch the model soar to 650 feet. Altitudes of around 2,000 feet are not uncommon, and speeds can easily top 400 miles per hour.

The engine, held securely in the rocket by a retainer hook, is electrically ignited with a short length of nichrome wire (of the type found in toasters) that has an extra high resistance section in the middle. Surrounding this high resistance area and extending out slightly along the leads of the igniter is a plastic coating which serves as electrical insulation to prevent the igniter from touching itself and short circuiting. In addition, the coating will burn when the nichrome wire is heated to 1,000 degrees F.

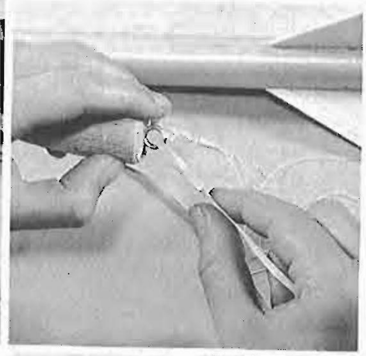
Once the rocket's launch lug has been slipped over the launch rod and the rocket has been lowered into position on the launch pad's deflector plate, the rocketeer attaches the micro-clips from a launch control system to the igniter. The launch control system, which usually operates on 12 volts, has a safety key or switch that prevents accidental firing. Standing at least ten feet from the rocket, the rocketeer inserts the key or turns the switch, makes sure that the continuity light comes on, and then starts his countdown just as it is done at the Cape, ". "...5...4...3...2...1...liftoff!" And as he presses the launch button, his bird streaks away from the launch pad and heads for the sky.

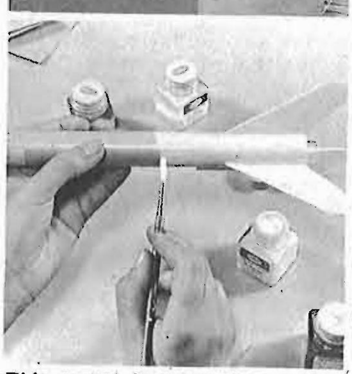
Engine burn-out occurs about a second later, when all the propellant in the engine is consumed, and thrust stops. Coasting now, the rocket continues on its skyward flight path, but slows down as the delay charge—ignited by the propellant—burns and leaves a smoke trail for tracking.

Reaching its apogee (peak altitude), the rocket turns over and starts to dive. Then, as the ejection charge is activated at the end of the delay (which lasts only a few seconds), the nose cone pops out of the body tube to de-

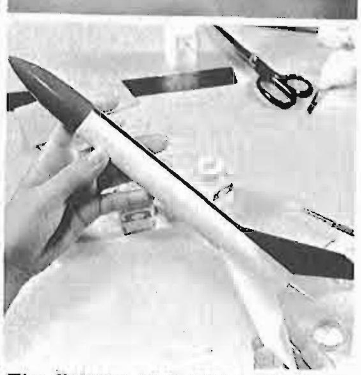
Tying the shock cord to eye—screwed and glued into nose. Cone slips into the body tube.

Shock cord is carefully tied to nose cone which is ejected by gas pressure to release chute.





This rocket is being given a base coat of white. It is important to avoid excess weight.



The finished bird. The engine, not shown, is propellant charge in fireproof paper housing.

ploy the recovery parachute or streamer. Soon the rocket lands softly, ready to fly again as soon as a new engine has been installed and a few squares of flame-resistant wadding have been placed in the body tube to protect the parachute from the hot ejection gases.

Sounds exciting, doesn't it? It is! And getting started in model rocketry is a fairly simple matter, as well as one that's easy on the pocketbook.

For instance, a popular beginner's model such as the Estes Astron Alpha costs only $1.50. For the same price, you can buy the Estes Alpha III, which has a plastic nose cone and plastic fins for easy assembly. It will take you just a few hours to build and paint the Astron Alpha (including drying time). The Alpha III can be assembled and painted in less than an hour.

For the youngster who would like to have a complete outfit as he embarks upon the great model rocketry adventure, there are beginner's kits that contain all that's needed: rocket, engines, launch pad, launch system, beginner's brochures, and even knife, sandpaper, glue, paints, and brushes. These kits cost less than $10.00 each.

After he has mastered the basic rocket building techniques and launched his bird a few times, the rocketeer has a tremendous choice of models that offer various degrees of challenge—models that range all the way from accurate scales of the multi-stage rockets that paved the way for our moon-landings to highly imaginative ones that could be the forerunners of the space vehicles of tomorrow. For instance, Estes makes an Orbital Transport which has a glider riding piggyback on the booster rocket. The Orbital Transport itself lifts off under rocket engine power. At parachute ejection, the "re-entry vehicle" detaches and glides back to earth while the booster returns by parachute.

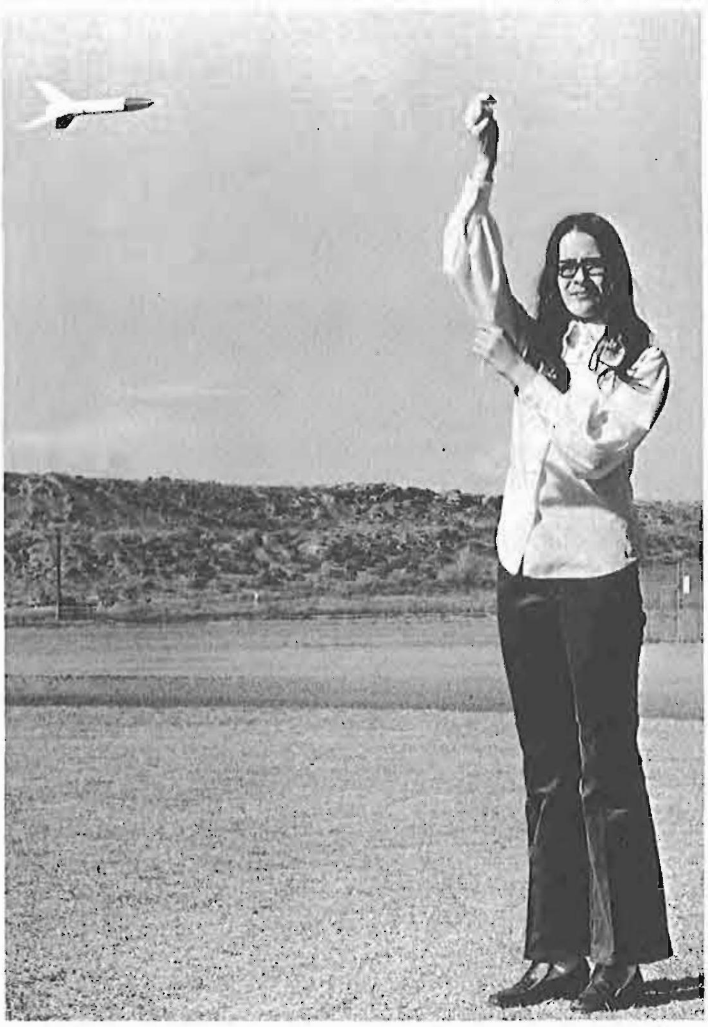
From the single-stage rocket, a young enthusiast can graduate to the two-stage models, built to demonstrate how real space ships operate. In a two-stage rocket, ignition of the engine in the lower stage launches the entire model. This engine, called "booster engine," has zero delay, meaning that it has no delay and ejection charges.

At burn-out, the hot gases leaving the front end of the engine casing ignite the engine in the upper stage. At that very moment, the lower stage separates from the model and falls away while the upper stage engine takes over and propels the rocket to its maximum altitude. The lower stage gently tumbles and lands softly enough so that it is not damaged. The upper stage has the usual parachute or streamer recovery system deployed by its engine's ejection charge.

More advanced three-stagers, such as the Estes Farside, can come later—high-flying multi-stage model rockets are definitely not for beginners.

One way to have lots of fun with model rocketry is to

The finished rocket is whirled on a string to test it for proper stability.



fly birds that can carry a payload. The payload compartment, located between the nose cone and the body tube and often made of transparent plastic, can accommodate live specimens such as grasshoppers, flies, spiders, earthworms, beetles, crickets, or guppies. The advanced rocketeer can study the effects of acceleration on the passengers by carefully developed experiments involving these specimens before and after launch. However, the use of mice or hamsters as live payloads is frowned upon.

What about launching an egg? Yes, an egg! And a raw one at that! To fly and safely recover a raw egg presents quite a challenge; and if you fail, you have a scrambled egg in your payload compartment. But it's fun to try. One such "egg rocket" is the Estes Scrambler, which is powered by three engines mounted in a cluster. This bird can take the egg to over 1,000 feet, and then bring it back to earth uncracked thanks to dual parachutes.

Recently, a new type of payload has been introduced which opens a brand-new world for the advanced rocketeer: miniature electronic instrumentation that transmits valuable data while your bird is in flight. These Rocketronics items include a transmitter that emits an electronic beep enabling the rocketeer to locate a model lost in tall weeds; a sensor that tells you how fast your rocket is spinning; and a microphone that allows you to hear all the sounds associated with the flight.

Then there are aerial model rocket cameras, such as the Camroc and the Cineroc, which let you photograph the earth from way up there. The Camroc takes a single black-and-white photo from hundreds of feet in the air, and the CINEROC shoots Super 8-mm color movies from well over 1,000 feet, capturing on film the spectacular happenings from blast-off to separation and recovery.

Yes, youth rocketry has indeed come a long way since the world's first artificial satellite launch stirred up the imagination of America's younger generation. Today, model rocketry is safe, fun, and scientific. It is the fastest growing recreational activity, and at the same time it serves a valuable function as a teaching tool in the classroom. Model rocketry can help demonstrate many principles associated with physics, mathematics, aerodynamics, optics, biology, astronautics, and electronics—and as such occupies an important place in many a school's curriculum.

For the beginning rocketeer, however, the whole idea is to build and launch a model. And for sheer excitement, nothing matches watching your sleek bird speed toward the sky and then, a few moments later, seeing the parachute blossom out. This is your rocket and, as far as you are concerned, it's the very best, the prettiest, in the world. And as you pick it up after it has gently landed you know that you are hooked. You are now a true model rocketeer—and you have just proved it.

feathercopters

THESE 200-YEAR-OLD MODELS PROVED MECHANICAL FLIGHT POSSIBLE AND INSPIRED THE YOUNG WRIGHT BROTHERS.

by HENRY D.M. SHERRERD JR.

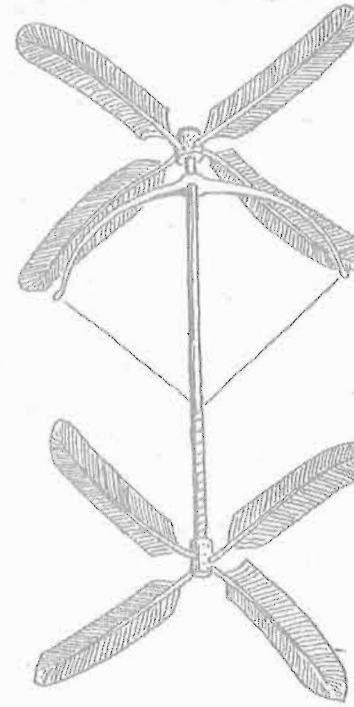
You know that the Wright brothers developed the first practical, man-carrying, heavier-than-air flying machine, and made the first successful flight on December 17, 1903. Sure. But do you know what originally fired their imagination with the possibility of mechanical flight? A toy helicopter. In 1878, when Orville was seven and Wilbur eleven years old.

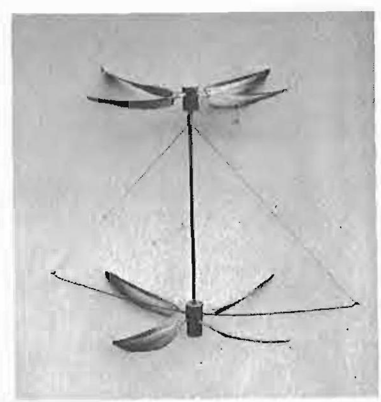
Helicopter? In 1878? That's right; about the time your great-grandfather was in fifth grade, Bishop Wright bought a toy helicopter for his sons and triggered a line of thinking that was to change the world, and is still doing so. The toy was based on the 1870 designs of Alphonse Penaud, a Frenchman, and what may be even more surprising is that his design, while including one important invention, was a modification of something almost 100 years older!

A working model helicopter at the time of the American Revolution? Right again. The story goes like this: In 1768, Paucton, a French mathematician, proposed what he called a "pterophore", which had one airscrew to lift it and another to drive it forward. There is no record that either a full-scale, man-powered machine, or a model, was ever tried, but apparently the idea inspired two more Frenchmen, Launoy and Bienvenu. They invented what they called an "Automoteur" (I call it a Feathercopter, or obvious reasons) and demonstrated it to the French Academy of Sciences in 1784. As one history book states, "it held their attention." It should have, for this was the first known machine capable of lifting and sustaining itself in free flight. It proved that mechanical flight was in fact possible, something that no one was entirely sure of up to that time. It was not a kite, depending on the wind to hold it aloft. It was not a glider, which cannot rise except on thermals and strong up-currents. It was not a boomerang or missile, which must be thrown. It was a true flying machine, lifting its own weight by means of its own whalebone-bow power source.

Sir George Cayley experimented with feathercopters in England in 1796 (George Washington was still President) and doubtless many other inventors as well, but no real improvements were made until 1870, when Penaud redesigned it to two-bladed form. Much more importantly, he also invented the rubber-band motor, and it was this development that made the difference between something that merely worked, and a practical flying model capable of remarkable performance.

The Histories say that a feathercopter will "rise to the ceiling," and that is just about all the author's reconstruction is able to do. That it flies is certain, but 5-second flights are not too impressive nowadays. On the other hand, Penaud's helicopters (the term had been coined in the 1860s) would "rise to 50 feet or more. . .for a period varying from 15 to 30 seconds." They still do—and much more. That, along with the difficulty of obtaining good feathers, is the best reason for building a





"Automoteur" of Launoy and Bienvenu of 1784. Actually, whalebone bow was attached to lower cork-hub.

Reconstructed Automoteur by author has 1/4-in. dowel, wine-bottle cork hubs, 1/16-in. wire bow, Mallard feathers.

Penaud model. If it started the Wright brothers thinking, what might it do for you?

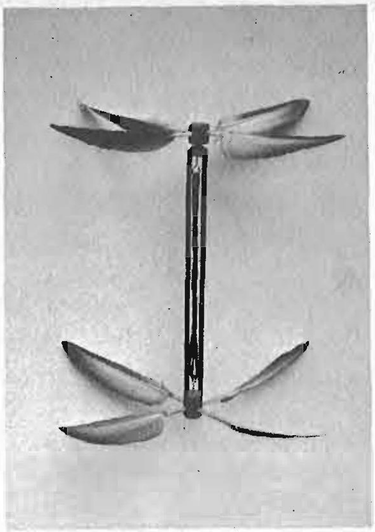
Construction of the Penaud is very simple. The most important point, perhaps, is in selecting good balsa. The 1/8th square for the frame must be as straight-grained as possible, and the harder, the better. If you feel the balsa begin to crush as you pinch it, look for something harder, it probably won't take maximum wind-up without twisting badly and possibly even breaking. Pre-glue all joints and after gluing spread a cement skin over the joint area as a final strengthener, especially around the balsa-aluminum hub.

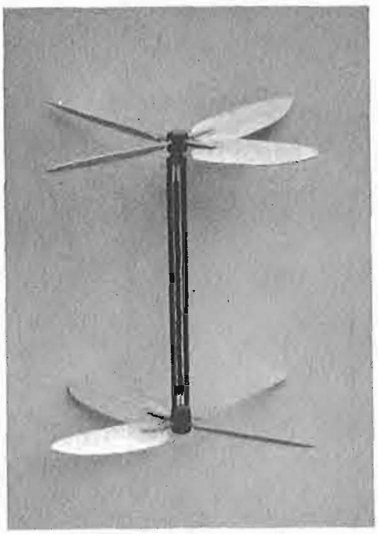
For a good, close-fitting joint at the hub, first cut a shallow "V" along the length of the balsa component. Then wrap a piece of fine sandpaper around the tube and work it back and forth until the "V" is transformed into an arc which exactly conforms to the curvature of the tube. For the upper, fixed hub, the tube is simply glued in place. For the lower, driven hub, the wire shaft must first be inserted, bent over, and embedded before the tubing is glued one. And don't forget the washers.

The blades should be of soft or medium 1/16th sheet. It is important to remember that you are dealing with a "pushme-pullyou" affair where the upper prop is right-handed and the lower left-handed. (The "handedness" of a propeller is determined by the direction it rotates when you look at it from the engine-side, with the slipstream in your face.) Or you can call them tractor (upper) and pusher (lower). Anyway, they rotate in opposite directions (obviously) and be sure the 1/8th roots are glued on in such a manner that both props have a slight amount of dihedral. (The blades tilt upward from the center as do some airplane wings.) So be sure to set them up as shown on the plan. Without such dihedral there is an excellent chance that, upon launching, the Penaud will rise a few feet, tilt over, and quietly dive into the ground, which is not good either for the model or your morale.

The Penaud will fly perfectly well with simple flat-plate blades—in which case you should use 1/32nd sheet balsa—but for noticeably better performance the blades should be given something like an airfoil section (like the cross-section of a wing). It needn't be very exact; just sand a bit off the leading edge and rather more off the trailing edge. This treatment reduces the weight to that of the 1/32nd flat-plate blade, and in addition offers the advantage of a true lifting airfoil. The glue at the root-joint will also curve the blade a bit.

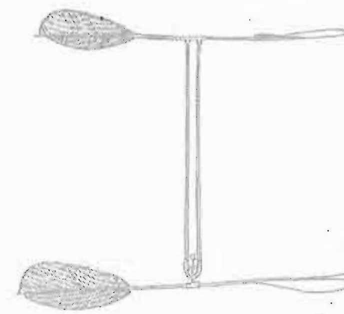
The roots should be rounded slightly on the corners and the ends. Just enough so that, when pushed into the hub-tube, a good, tight fit results. This fit will remain firm for many flights and adjustments, but eventually it will loosen. When it does, just sand a bit more off the root, then bind it with a turn or two of masking-tape to bring the

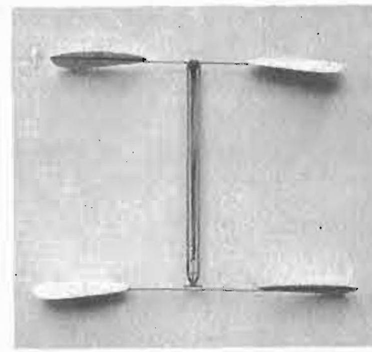




Modernized Automoteur has cork hubs, balsa frame, Mallard feathers. Autorotates down in upright position.

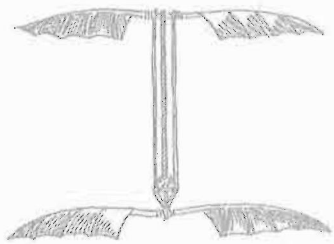
Same as the model above, but with balsa blades patterned after feathers, Climb is slower but still impressive.

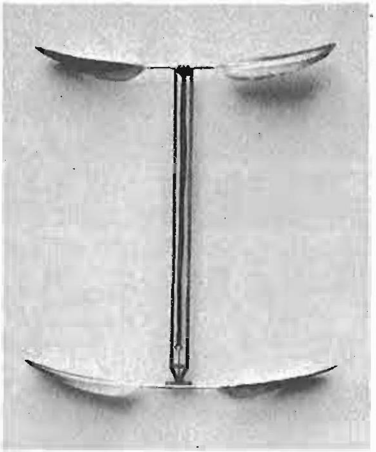




Penaud design of about 1870. Note triangular hub structure. Bat-wing blades probably bamboo, tissue.

Author's Penaud Feathercopter. It has fast climb, but will not autorotate smoothly to earth like 4-bladed types.





diameter back up to tight-fit dimensions. Or make a new root; it isn't that difficult.

No dope or finish of any kind is used. It only adds unnecessary weight.

At least two loops of 1/8th flat rubber are required for a good climb, and are more than enough for back-yard or indoor flying. If you have a big field available, try three, or whatever you think the frame will take. The more power, the higher it goes; it's as simple as that.

For first flights, set the upper blades at about a 30-degree angle and the lower at somewhat less—say 15 or 20-degrees. This is a good "normal" setting for a strong, stable climb, and unless the props are wildly unbalanced or the shaft way out of line, should produce that rarest of all flying phenomena; a good first flight. If it tends to wander about in circles, that means the blade angles are not the same. You can use a protractor to set them, or course, but the human eye is capable of amazingly fine angular discrimination, and setting the blade angles by simply eyeballing it is usually good enough. Just be careful. Now wind it about as much as you think the flying area allows, and watch out for the wind; the Penaud drifts with it.

And then you're on your own, just as Penaud was. The variable-pitch feature makes the model a virtual flying laboratory, capable of demonstrating far more principles of stability and aerodynamics than it is possible to discuss in this article. But here are a few things to try and then think about:

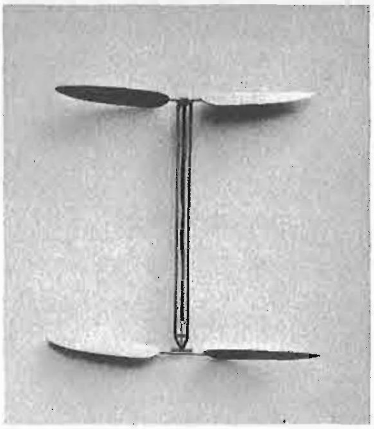
The setting of high pitch on the upper blades and low pitch on the lower blades produces a stable climb. What about the reverse? That is, low pitch on the upper blades and high pitch on the lower. Try it and see. And what happens in the following cases:

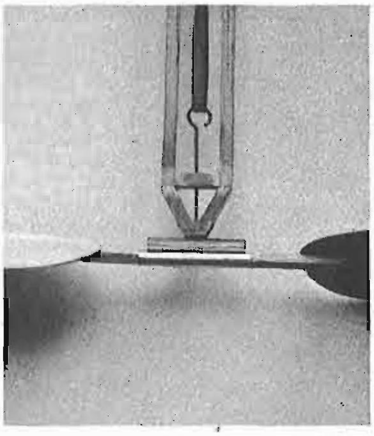
Upper blades 30 degrees, lower blades 0 degrees? And the reverse?
Upper blades 90 degrees, lower blades 30 degrees? How about the reverse?
Both sets of blades at 9 degrees, so they act like tiny, revolving wings, not like propellers.
One set of blades at 30 degrees normal, the other at a very slight negative angle, so it actually fights the normal-setting blades.
Which if any of these settings will produce a steady, non-climbing hover? Yes, it can be done, with enough careful adjusting.

And so on. And when you've exhausted these possibilities, you might try different blades shapes and sizes: paddle-blades or bat-wing blades, like those of Penaud. Almost all modern helicopters use straight, non-tapered blades—how about them? What about reverse-taper, that is, toward the hub? And what if the roots are longer for one set than the other? The Penaud paddle-blade model is set that way, with the upper blades having a slightly smaller diameter than the lower. Why did he do that? There's a good reason for it—try it, and learn something, and have fun at the same time.

Another Penaud type of about 1870. Hub from metal tubing. The blades were made from cut-down feathers.

Author's reconstruction of the Penaud shown above. Balsa blades, low rpm, very stable. Three rubber loops.





Author's modernized Feathercopter based on Penaud design. Full-size plans appear in continued section.

Close-up of the construction of propeller hub, and nose. This model has the best all-around performance.

THE STICKY GLUE MESS!

A person who wants to "build something" today, be it a model plane, a miniature house, a racing car, or whatever, is confronted with a bewildering variety of cements and glues. And incidentally, what is the difference between a glue and a cement? According to our dictionary there is very little—both are materials to make objects adhere to each other. So we can apparently use the terms interchangeably, since they are all adhesives!

Because of the rather tough conditions that adhesives must endure in model planes, we will write generally in terms of planes—but you could apply the following comments just as well to other structures you wish to build. Planes require lightweight adhesives of great strength, since they take quite a beating in use; and the cements are often exposed to engine fuel and oil, and to great vibration. Cements that will hold model planes together will hold most anything else you want to build. You just have to choose which cement is best for the type of material in use.

There are four main types of adhesives used in model planes. The most common is called simply "model plane cement." This material is light, works fine on porous materials, is easy to use, fast drying, and easy to sand. It works by evaporation of a special solvent—hence the pungent odor the cement has. As the solvent evaporates, the cement shrinks, weight is reduced, and soon you have left a rather transparent skin on the materials to be joined.

There are several grades of such cement and dozens of makes. All vary to some extent, but basically they can be classified as slow-, medium-, and fast-drying, and as fuelproof or non-fuelproof. For many home purposes, fuelproof qualities are not needed—but most model cement sold in hobby stores today is fuelproof. Every model builder has a particular favorite brand among model plane cements. If you don't require fuelproof qualities, you might try what are often called "household cellulose cements," which may be cheaper and just as satisfactory for some uses.

Generally, one should use the slowest-drying cements. These still dry rapidly—often they are set quite firmly in 15 minutes or so—but because they are slower drying, they have more of a chance to penetrate the porous areas of the materials being adhered. Fast-drying cements are often used for field repair of models, where damage must be patched up in the quickest possible time. Needless to say, these cements have much less penetration, therefore do not make as firm joints.

"Double-cementing" is often used where utmost strength is required in a joint. Even with slow-drying cement, when one smears cement on a strip of wood, for example, then clamps another piece on top of it, a lot of the adhesive is squeezed out of the joint before it has had a chance to soak in well. In double-cementing, one puts a light coating on both of the surfaces that will be in contact, then lets the cement dry for 10 minutes or so without bringing the pieces into contact. Then another light coating is applied to both pieces and the two are brought tightly together. A joint made this way will almost invariably tear apart the wood fibers, rather than break at the cement line.

Model cement tends to evaporate and thicken in the tube (most of it comes in tubes) even though the latter are kept tightly closed. The thicker it becomes, the less effective it is—since it can't properly penetrate the wood pores to make a firm joint.

So-called "white glue" has many uses in model building. This is a water-soluble mixture; if it becomes too thick, a little water will bring it back to proper consistency. It is very strong, holds well on both soft and hardwood. It tends to cause warpage on some balsa construction, due to its water content. Drying is rather slow compared to model cement, but joints might be firm in half an hour or so—although they won't be fully "dry." White glue is very difficult to sand when it is dry, for which reason all excess glue should be wiped off the joint area with a damp cloth. This glue is not waterproof as is model cement. It is useful for joining large areas of materials, keeping in mind the possibility of warpage.

Because white glue is so hard to sand, model builders often prefer a material with the trade name of "Titebond." This also is water-soluble, works much like white glue, but it is easier to sand when dry—although still not as easy as model cement. This sanding quality is most important on balsa wood, especially in the soft grades.

SO MANY KINDS AND BRANDS OF 'MODEL AIRPLANE' ADHESIVES EXIST THAT EVEN AN EXPERIENCED HOBBYIST CAN BE CONFUSED. SELECTING THE PROPER ONE FOR THE JOB IS MIGHTY IMPORTANT.

by HOWARD McENTEE

One invariably gouges the surrounding surfaces of the balsa when trying to smooth down the area where excess white glue (or Titebond) has dried.

Though white glue is a thick milky consistency when applied, it dries almost clear. Titebond is a thick tan-colored material, but dries to a yellow film.

Epoxy glues are coming into wider use in the hobby and model plane field. These are two-part glues, which must be mixed shortly before use. Since one always fears not having quite enough to do a job, the tendency is to mix too much—wasteful! Epoxies are extremely strong. One reason is that they dry or "cure" by chemical means, rather than by evaporation of a solvent or water. Thus all the glue you apply to a joint stays right there (barring that squeezed out when you clamp the parts together, of course). Epoxy fills all the voids in the joint and none of it evaporates from joints. Thus, glue is in contact with the entire surfaces of both parts to be joined.

While epoxy works well on balsa—and causes no warpage—it is rather expensive for such use. Most builders utilize it mainly for joining hardwoods—strips, sheet, plywood parts, etc. It also works well on metal (the metal surface or surfaces should be roughened to give the adhesive a better grip) and on some plastics. Although it's fine for hard materials, it is also prefered for the softest! Many model planes have wings with cores of the very lightest polystyrene foam; many materials (including model cements) dissolve this foam, but epoxy doesn't. Since it fills all crevices in a foam joint, the joint is much stronger than the foam itself.

Epoxies are completely fuelproof, leading to their extensive use around the nose of powered model planes, where even "fuelproof" model cements will loosen in time.

As with model cement, epoxies come in several grades that differ mainly in drying (usually called "curing") time. Some of this material will cure in five minutes—you have to work fast or you'll have a solid mess on your hands before a job is completed! Others in wide use cure in about 15-20 minutes, still others in perhaps an hour. As with any other cement, the slower-curing varieties allow more time for penetration into porous materials. It's better not to use the five-minute epoxies on such materials unless top joint strength is not an important factor. However, entire model planes have been built with the five-minute material, when a modeler was in a real hurry, for his joints would harden almost as fast as he could make them!

While model cement may be softened by a fresh application of the same cement over the first, and the water-soluble glues may be softened by continued application of moisture, once epoxy sets there is nothing that will soften it—you'd better make the joints right the first time!

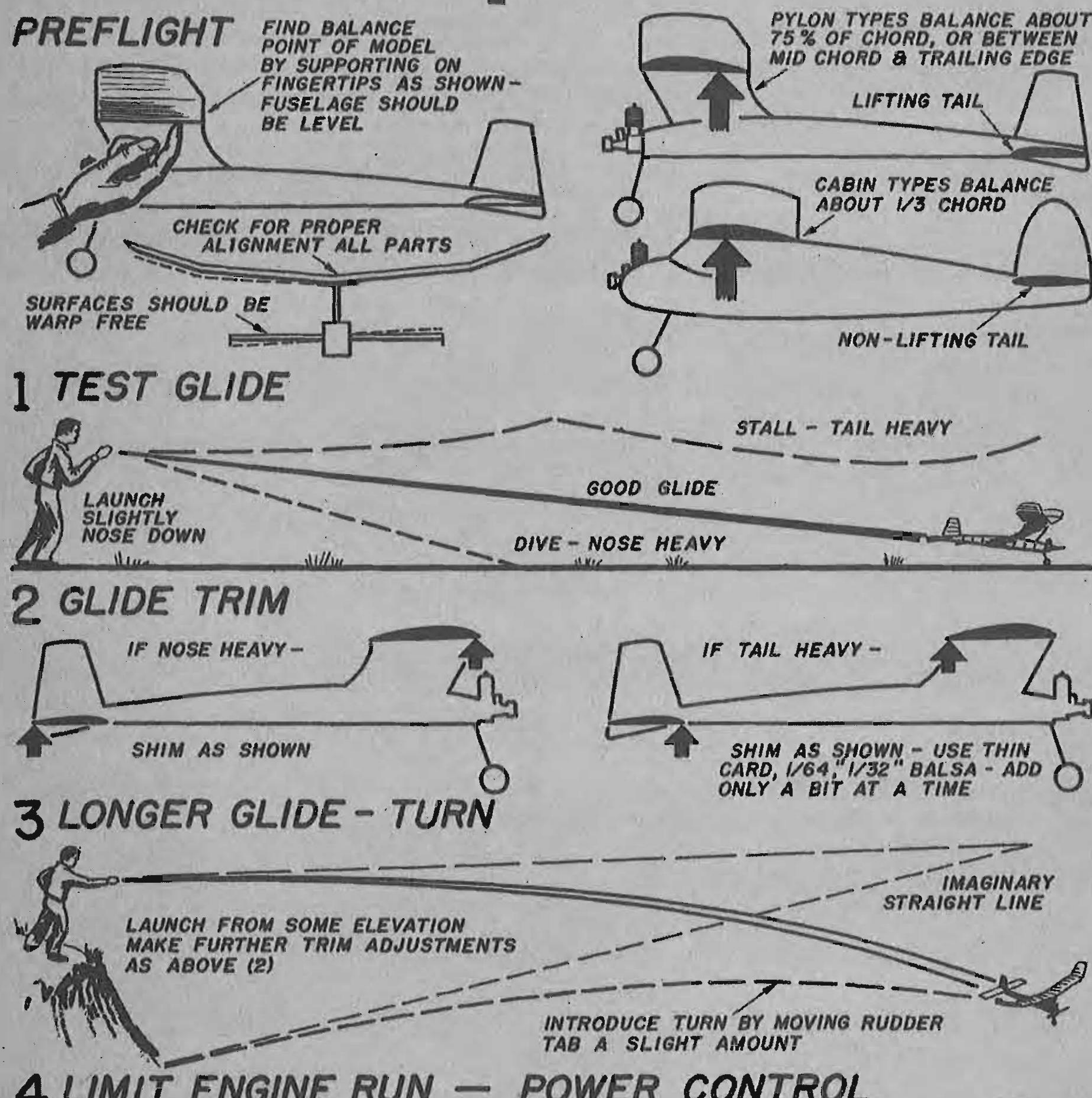
The fourth main class of adhesives is the contact cements. While not as versatile as the materials we have covered, these have important advantages for some jobs. These adhesives are applied in a thin coat to both surfaces that are to be joined, then allowed to dry for a few minutes. When the surfaces are brought together, they are stuck for good. You must make the joint right the first time, by careful line-up and so on, because these adhesives just won't let go. They can be loosened by certain solvents, however. Contact cements are used mostly where large areas must be joined; in model aviation, the most widespread use is to attach balsa, thin ply or other sheeting to foam wing cores. Special contact cements have been formulated that will not attack the foam. The cement may be brushed on or you can get it in spray cans.

Most of our readers have probably used rubber cement. This too is a contact adhesive and works exactly the same way, but the grades used in model building are far stronger. Such cements are useless for small joints—fastening balsa or hardwood sticks together, for example. Actually, that material never really gets hard as do the other adhesives we've mentioned; even though they might not actually come apart, small-area joints made with contact cement could slowly slip until the structure was badly out of line. Large area use precludes such slippage.

We have other special-purpose adhesives with rather remarkable properties, but the four mainstays covered will answer most all needs of the young hobbyist, who can then try the specials when he has a definite need for them.

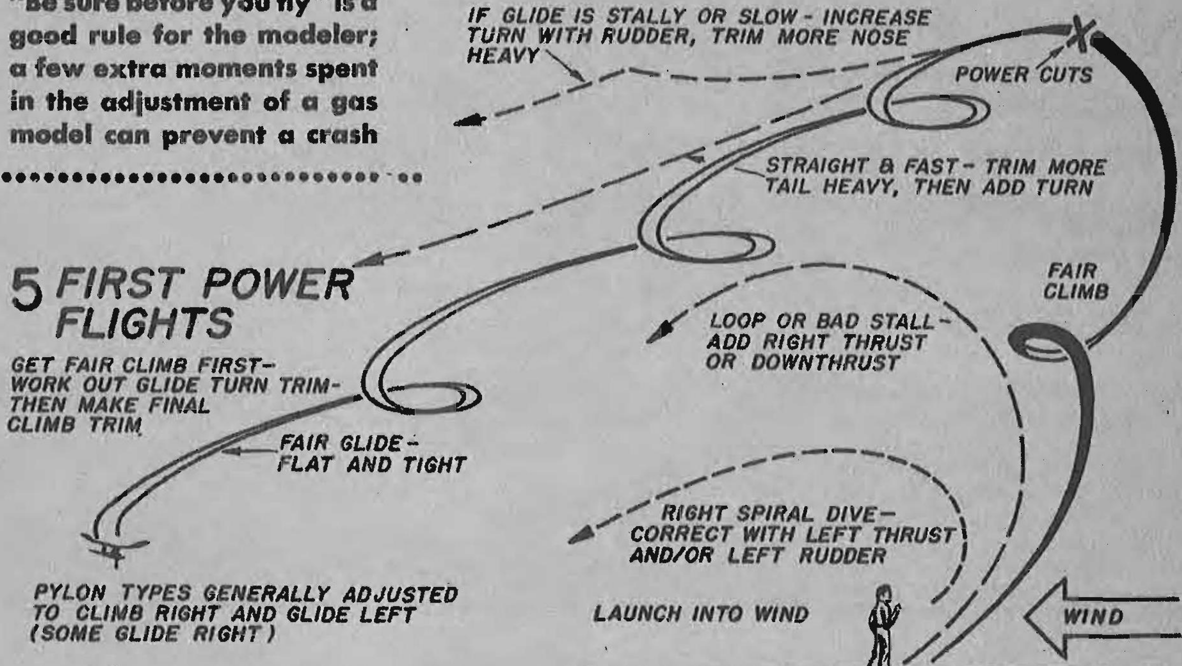
air model manual

ADJUSTMENT OF FREE FLIGHT GAS MODELS

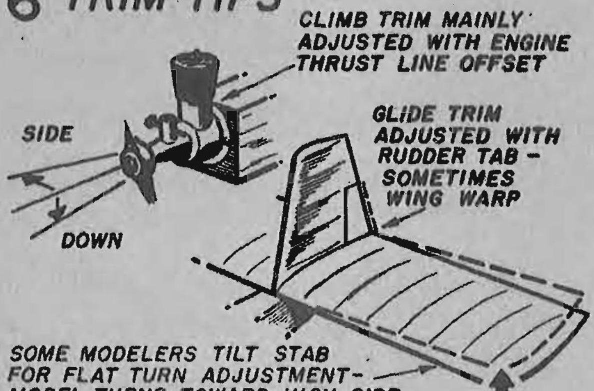


"Be sure before you fly" is a good rule for the modeler; a few extra moments spent in the adjustment of a gas model can prevent a crash

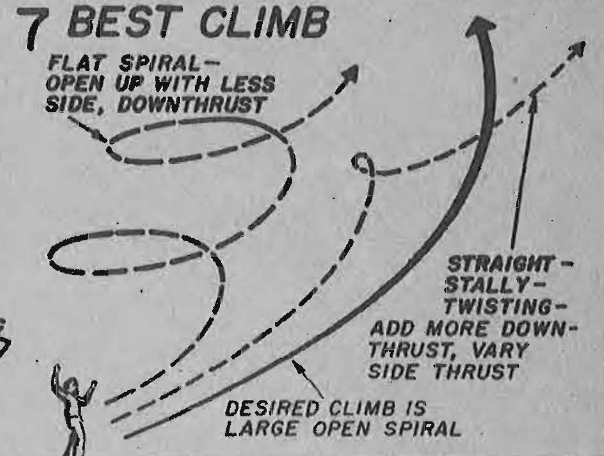
5 FIRST POWER FLIGHTS



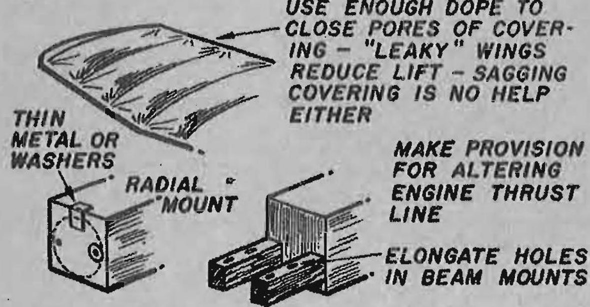
6 TRIM TIPS



7 BEST CLIMB

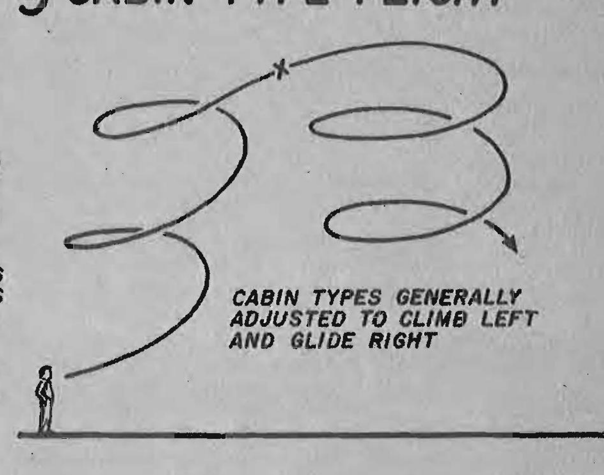


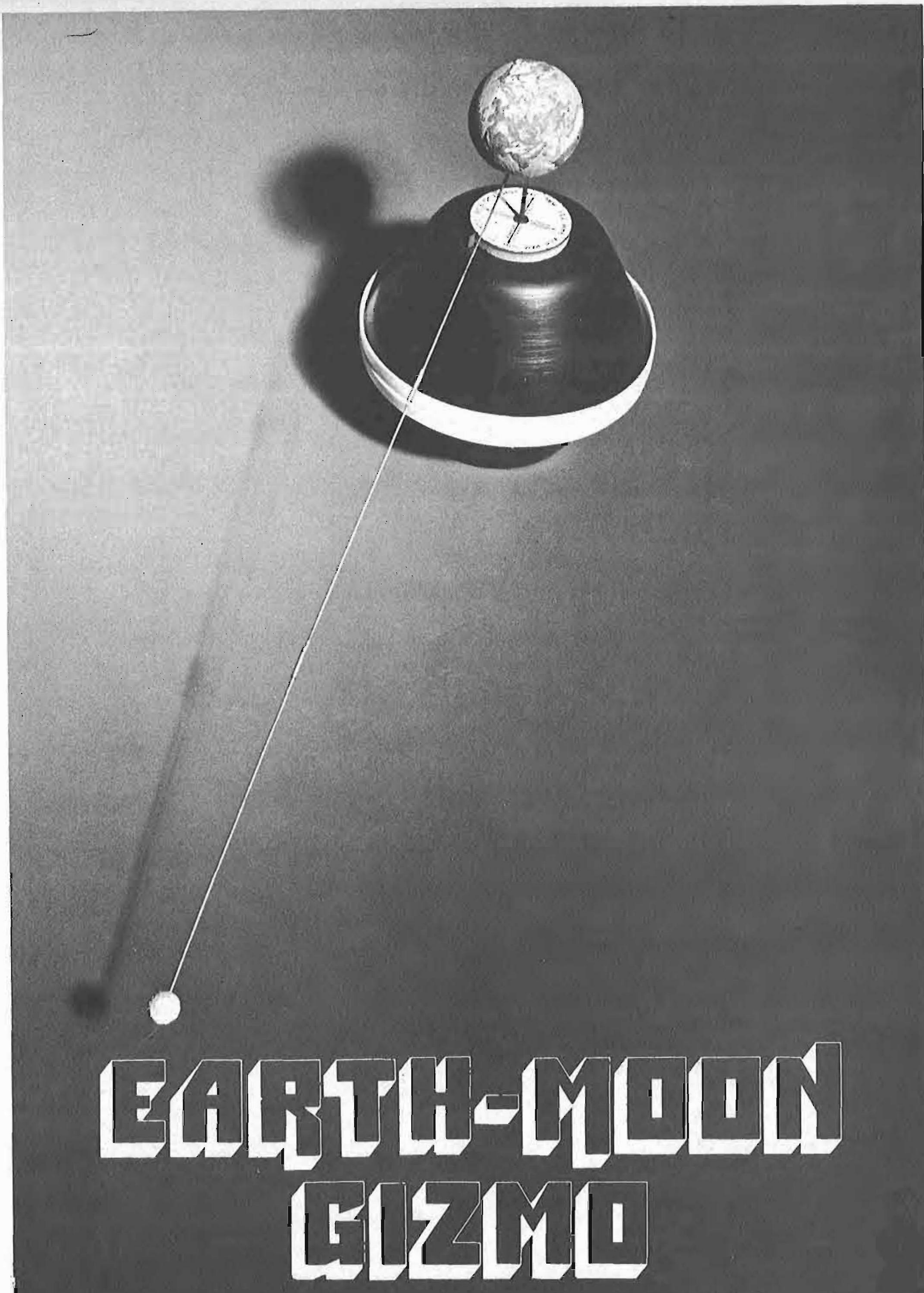
8 DESIGN TIPS



USE PROP RECOMMENDED FOR ENGINE - FLY WITH SAME TYPE ALWAYS - CHANGING PROPS ALTERS THRUST - SO CLIMB TRIM WILL HAVE TO BE CHANGED

9 CABIN TYPE FLIGHT





EARTH-MOON GIZMO

HERE'S A GREAT SCIENCE PROJECT—USE YOUR MODELING SKILLS TO DEMONSTRATE PHASES OF THE MOON, HOW SEASONS OCCUR, AND ECLIPSES OF SUN AND MOON.

by PAT MARCH

They called him a liar. And he did not really believe the story himself. Herodotus, called the "Father of History," felt duty-bound to report the story of the early Egyptian explorers who said that the sun was to the north as they rounded the Cape of South Africa.

As a conscientious reporter, Herodotus recorded the position of the sun as described by those early explorers, but no one believed it and the information was lost for almost 2,000 years.

With your own Earth-Moon Gizmo, you can show why Herodotus' report was accurate, even though he was not too sure of the story himself. The E-MG demonstrates some things which would have made life less confusing to ancient scholars.

Modeling astronomical objects requires astronomical scales. The approximate scale of Earth-Moon Gizmo is 1 in 250 millions—and I still had to cheat on one dimension!

Maybe it is easier to think of the scale as one inch equals 4,000 miles. Then an 8,000-mile diameter earth becomes a handy two-inch ball, and the 2,000-mile lunar diameter reduces to a mere half inch. However, the distance from earth to moon (240,000), scales to an awkward five feet, so this distance is "cheated"down to 18 inches.

The sun's distance from earth (93 million miles) would come out to about 2,000 feet. This problem is completely ignored in this model. A lamp set six or eight feet away serves as a sun.

The Earth-Moon Gizmo can be used to demonstrate phases of the moon, how seasons occur, and how eclipses of sun and moon would look from space. With the size of the moon's orbit reduced still more, it makes an attractive conversation piece for desk, wall or ceiling.

The most difficult portion of constructing E-MG is mapping the earth. It is suggested that the ball be painted blue before marking in the land. The pattern provided is suitable for a two-inch ball. I used an expanded polystyrene ball swiped from a toy. If the ball you use is not two inches in diameter, the map pattern can be photostated to scale. Wrap the pattern around the ball, holding it on with pins and tape. Transfer the outlines by pricking through with a pin. You will find that the pattern is not a perfect fit (an inevitable consequence of trying to draw a spherical surface on a flat piece of paper), so some artistic license in drawing the outlines is allowable.

An atlas will help the painting process. Look for deserts; paint them light tan or pink. Look for mountains with snow caps; build them up with thickened paint. The atlas can be most distracting. Who could avoid a minute's daydream when confronted with names like Tahiti, Sarawak or Tahanarive?

The moon should be one-quarter the size of the earth. I used a slightly undersized rubber ball painted with very thick, white military flats. When partly dry, the moon was cratered by dabbing with a pointed stick. The white was a bit too bright to be believable, so it was yellowed slightly with cigarette smoke. However, this hazardous substance is not recommended.

The earth is mounted on an axis made of coathanger wire bent according to the pattern on the plan. The bend is necessary to provide the 23½-degree inclination of the earth's axis from its orbit. Washers are soldered (or epoxied) in the positions shown. A two-inch-diameter disc is cemented to the axis to support the month dial, cut from the plan.

I used masonite for the disc, but plywood, balsa, or even heavy cardboard will serve. When cementing the dial to the disc, care should be taken that the bend in the earth's axis is directed exactly toward the "summer solstice" line.

The moon is mounted on a 3/64 inch-diameter steel wire. The mounting was made up in three pieces as shown on the plan so the whole model could be disassembled and stowed within its own base. The joints are made from half-inch long pieces of 1/8-inch brass tube, flattened to fit, and soldered in place. The end of the wire opposite the moon is bent around another half-inch long piece of 1/8-inch tubing, and soldered in place. The wires should be bent slightly to bring the moon into the plane of the earth's equator.

A very attractive base for the model was made from two margarine tubs (Nu-Maid). The lids were fastened together with four small nuts and bolts as shown on the plan. A few holes stabbed thru the lids with the point of a knife serve as places to hold the earth's axis and the moon wires for storage. The earth itself merely drops into one of the tubs—or a special compartment inside could be constructed, if desired. For wall-mounting, a single tub and a shortened moon arm is recommended. Simply tack the lid to the wall, and snap the tub in place.

A 3/32 inch-diameter hole is drilled in the exact center of the upper tub to accept the earth axis. A small metal tab screwed to the tub serves as an index for the month dial. The usual coathanger wire is slightly fatter than 3/32, making it a comfortably snug fit in the tub and in the 1/8 tube on the moon arm. Since the fit is so close, any burr on the ends of the axis will prevent the wire from fitting. The burr can be removed by filing to a rounded point.

The best "sun" is a high intensity reading lamp, but a 100-watt bulb also serves well. A piece of cardboard screening the 100-watt bulb, with a one-inch diameter aperture cut in it makes sharper eclipses. For demonstrations, the sun should be set up level with the earth. The model's base should be turned so the shadow of the dial index falls toward the center of the month dial.

Let's see what can be learned from this set-up. Turn the vernal equinox to the dial index. This is the conventional first day of spring. If the model has been properly constructed, both north and south poles will be just getting sunlight. The dawn and sunset lines will run from pole to pole. Northern and southern hemispheres are now both getting exactly the same amount of radiation. What is the relative length of day and night?(1)

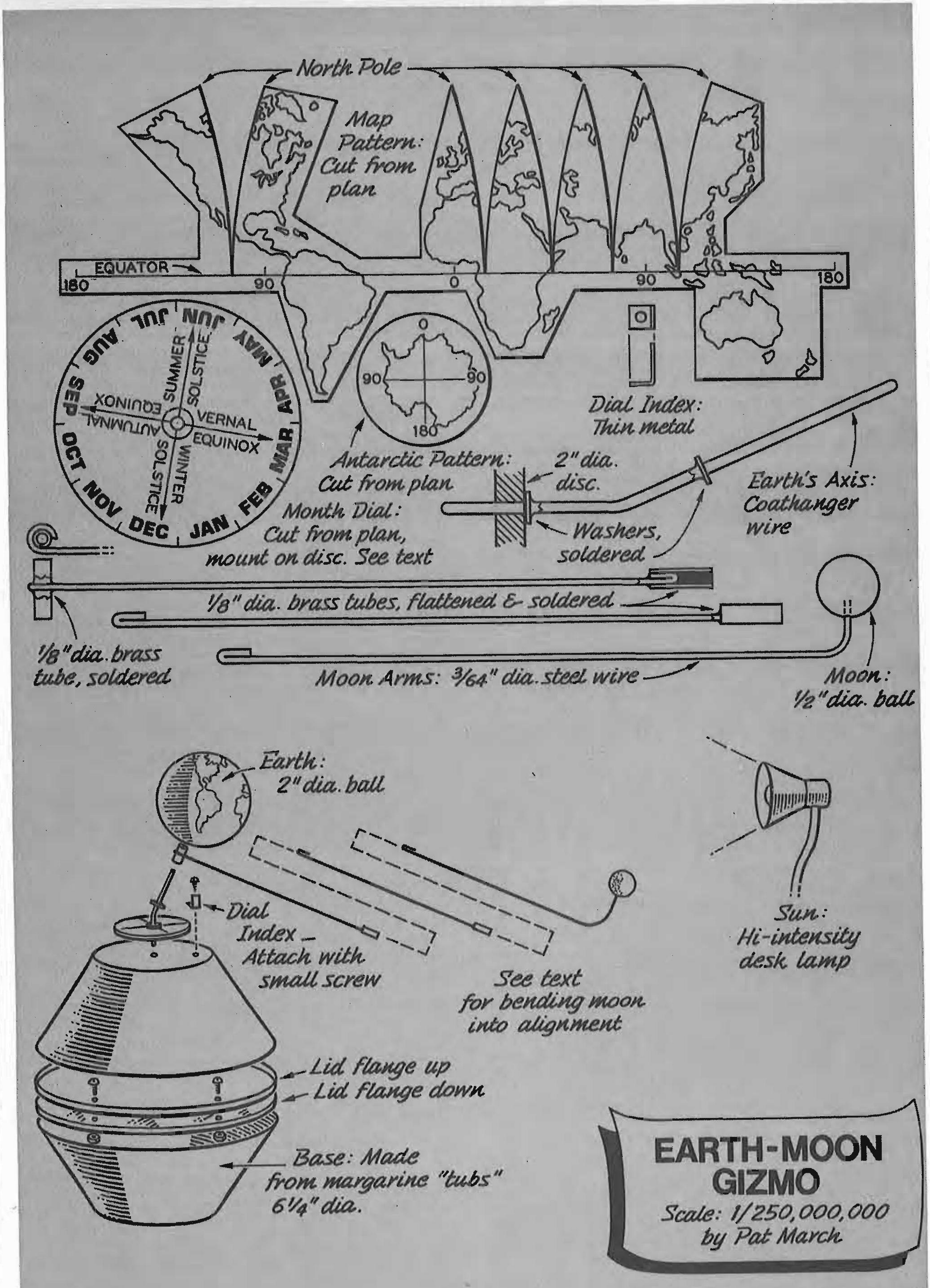
Now swing the dial to the summer solstice. The north pole now gets sunlight regardless of the time of day. It's summer in the northern hemisphere. The Antarctic, however, gets no light at this time of year. The ancients called an explorer returning from the south a liar when he stated that his shadow fell to the south. Did he have to go south of the equator for this to occur?

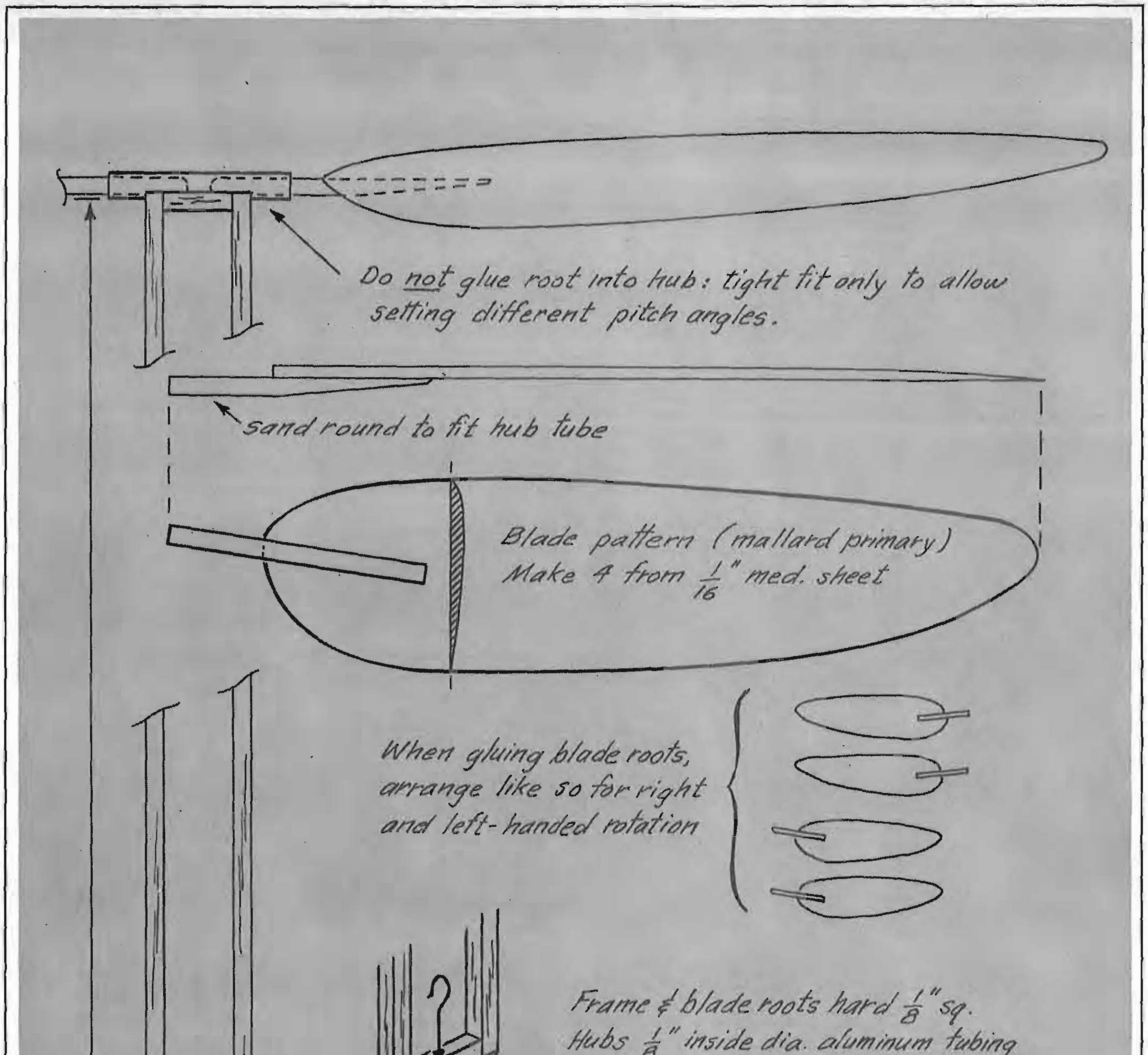
Let's get the moon into the act. Can you see a full moon at noon?(2) A new moon at midnight?(3) At Sunset, in what direction must a full moon be looked for?(4)

Now for some eclipses. Turn the dial so it is close to one of the equinoxes. Swing the moon so that its shadow falls on the earth for a solar eclipse. Then swing it around to the dark side for an eclipse of the moon. Some thought and tinkering should indicate that lunar and solar eclipses occur with about the same frequency.

How come, then, lunar eclipses seem to occur more frequently than solar eclipses?(5) What's the phase of the moon during a lunar eclipse? (6) During a solar eclipse?(7) It should be possible to devise some elaborations on this model. One possibility is a sun dial consisting of a 24-hour dial and pointer attached to the north pole. This could be adjusted to give the correct solar time for any point on earth.

(Continued on page 48)


North Pole
Map Pattern: Cut from plan
EQUATOR
180
90
0
90
180
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
SUMMER SOLSTICE
VERNAL EQUINOX
AUTUMNAL EQUINOX
WINTER SOLSTICE
0
90
90
180
Dial Index: Thin metal
Antarctic Pattern: Cut from plan
2" dia. disc.
Earth's Axis: Coathanger wire
Month Dial: Cut from plan, mount on disc. See text
Washers, soldered
1/8" dia. brass tubes, flattened & soldered
1/8" dia. brass tube, soldered
Moon Arms: 3/64" dia. steel wire
Moon: 1/2" dia. ball
Earth: 2" dia. ball
Dial Index - Attach with small screw
See text for bending moon into alignment
Sun: Hi-intensity desk lamp
Lid flange up
Lid flange down
Base: Made from margarine "tubs" 6 1/4" dia.
EARTH-MOON GIZMO
Scale: 1/250,000,000
by Pat March


Do not glue root into hub: tight fit only to allow setting different pitch angles.
sand round to fit hub tube
Blade pattern (mallard primary)
Make 4 from 1/16" med. sheet
When gluing blade roots, arrange like so for right and left-handed rotation
Frame & blade roots hard 1/8" sq.
Hubs 1/8" inside dia. aluminum tubing
FEATHERCOPTER
Original development by
Alphonse Pénaud, ~1870
Reconstruction by H. Sherrerd
Designed ~1965, Drawn 1971
10"
washers

Pylon Polisher
(Continued from page 13)

From then on, any time somebody put on a race for the big, fast, powerful Unlimited racers, Clay Lacy was there. At Lancaster, Calif., in 1965, he came in second. At Reno, later that year, he was third. Two weeks after Reno, down south near Las Vegas, he cut a couple of pylons and came in fifth. The flying hot-rods were winning these races, but they were starting to have trouble with their engines which can't always stand the beating.

Early in 1966, back at Lancaster, Clay Lacy almost pulled it off. He led the championship race right from the start until the next-to-last lap. With a big lead on the field, it looked like he had the race in the bag—when a $1.50 part in his propeller hub broke. The prop went into high pitch and Clay had to make a very quick landing. All that was hurt was his pride, though he was enough of a sport to wear the broken part on a string around his neck when the trophies were presented that evening.

Despite such bad luck, he stuck with it. In 1967, 1968 and 1969 he again placed third in the big meet at Reno, and it looked like he was stuck. While third is a lot better than last, or even fourth, it still isn't anything like winning. And winning was what Clay Lacy was in air racing for. Other kinds of flying can be exciting and satisfying, but only in racing can a pilot get the true thrill of tearing around with the best and beating them, fair and square.

Lacy was getting more than his share of exciting flying, even if you don't happen to think that jockeying a DC-8 between Los Angeles and New York is much action. The first test flight of something as off-beat as the bulging "Guppy" has to be pretty thrilling, and Lacy was at the controls that time. If it's drama you want, imagine yourself flying the camera plane on that sad day when the great test pilot, Joe Walker, crashed into the majestic B-70 and both went down in flames. Lacy was flying the photographers in a Learjet that day.

But it was still racing that turned him on more than anything else. Yet winning was still beyond his reach, mainly because of super racers like Darryl Greenamyer's great white Bearcat. Lacy and his friends had the brains and skills to come up with a super P-51 that might have given Greenamyer quite a fight, but then the pretty purple airplane wouldn't have been much good for anything but racing.

So how do you win with a stock airplane when some of the other pilots have souped-up ones? You've got to be patient, and wait for your chance. The hot ones have a habit of going like the wind for a short time and then giving out, usually because of a broken engine. When that happens, a really fine stock racer has a good chance to come home in front. After all, to win a race you have to fly all the laps.

And after six exciting but winless seasons, Clay got his big chance at Reno in 1970. The "hot iron" was having trouble. Chuck Hall's gorgeous P-51 never got off the ground. Cliff Cummins' slick Mustang was on the ground for good, having bellied-in during a heat race. In the championship race for the Harrah's Trophy, Greenamyer couldn't get his landing gear up, while the huge engine in Lyle Shelton's Bearcat blew up during the second lap. Lacy poured it on, feeling that his time had come. Despite being hard pressed by Mike Loening, Howie Keefe and other veterans, he screamed over the finish line with a good lead, and won!

Or so he thought. A pylon judge said Lacy had cut a pylon, so the officials dropped him all the way down to fifth place. Clay protested, the pylon judge admitted he wasn't doing his job the way he should have, and after a lot of arguing, the beautiful trophy was finally handed to a tired Clay Lacy. After seven long years, he had at last won the big one. No doubt about it, it pays to be determined.

Especially if you have a purple airplane!

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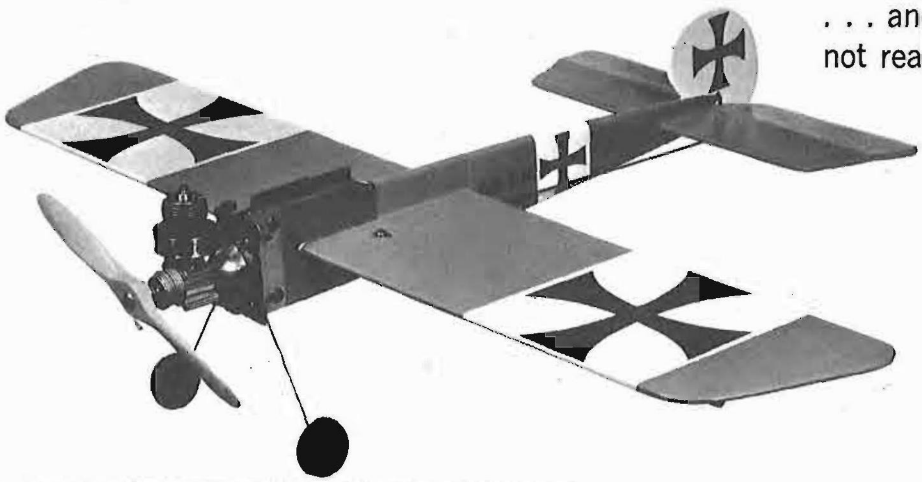

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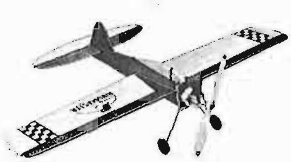

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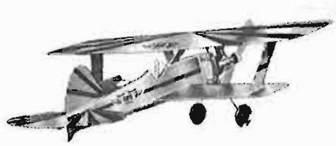

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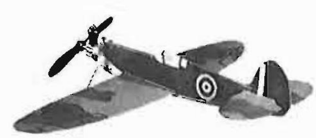

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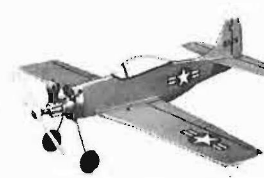

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Earth-Moon Gizmo
(Continued from page 41)

Another possibility is the mechanization of the device. Something like this was done, with day and month simulated with a 30-to-1 worm gear drive working from a toy motor. Since the lunar month is approximately 29 days, why would 30:1 be the correct ratio rather than 29:1?(8) Regrettably, it is not practical to detail the motorized version because of complexity and difficulty of obtaining suitable parts.

A severe drawback to this model is that it could give the impression that eclipses can occur only close to the equinoxes. That is because in the model, the moon is in a strict equatorial orbit, as if only the earth influenced its motion. The true orbit would be unbelievably complicated to simulate. Also, because the lunar distance is so short, eclipses occur much more readily in the model than in nature, and the moon's shadow is about three times as large as it should be.

I would be happy to hear of successes (or difficulties) with this model. Write to me, care of this magazine.

Answers

1. Day and night are equal at the equinoxes.
2. No. He would have to be south of a line from the center of the earth to the center of the sun. At the summer solstice, he would have to be farther south than 23½ degrees from the equator. That is, he would have to be within the tropics.
3. No. Full moon at noon or new moon at midnight is impossible. The Model shows it better than any explanation.
4. At sunset, if the moon is full, it will be seen in the east (Harvest moon).
5. When an eclipse of the moon occurs, all of the people on the night side of the earth can see it, but an eclipse of the sun is seen only by those people within the rather small shadow cast by the moon.
6. Lunar eclipses occur only at full moon.
7. Solar eclipses occur only at new moon.
8. The difference between the number of revolutions of the earth and rotations of the moon determines a lunar month.

It's Sam!
(Continued from page 9)

To complete the gluing operations on this model, add the line guide to the left wing, wing tip weight to the right wing (a nickel is about the right weight) and the plywood bellcrank mount to the left wing. This last may not be essential if you used pretty firm wood for the wing. But it's not a bad idea to use it.

Now Uncle should be ready for his first two coats of clear fuel-proof dope (butyrate type). Don't forget also to dope his coattail elevators which are still unattached to the rest of the model. Unhappily you will find that when this dope has dried, Sam will be somewhat fuzzy again, so gently smooth him down again with very fine sandpaper.

Mask off with masking tape those areas that are to be painted white. This will include the upper portion of his hat, his beard, cuffs, and trousers. Apply one coat of clear dope to the edges of the masking tape to avoid the color seeping under, and when this has dried give two coats of white. With the white dry, mask as before for the red areas: stripes on hat, cuffs and trousers, and when the red dope is dry, again mask off for the blue areas remaining and for his black shoes. The clear finished balsa will serve nicely as the flesh color of his hands and face. The features of his face can be drawn with a felt-tipped pen.

The stars, so essential to our Uncle's costume, are the little gummed paper stars sold by dime stores. The silver ones are particularly striking when applied, using model cement, to hat band, coat and coat tails, and blue stars on the cuffs. It will be necessary to protect these stars with a coat of fuel proofer or use a spray can of clear fuel-proof dope to avoid smears.

Now it's time for the control system. After mounting the control horn, the coattail elevators are attached to the wing using a strip of blue Mystic brand cloth tape across the bottom as a hinge. Allow a gap of 1/16" between the wing and elevator to insure free movement. There is no simpler way to hinge a ½A-size model, and it makes a very free moving hinge indeed.

The pushrod is next bent from a piece of .045 music wire, inserted in the holes in the horn and bellcrank and the bellcrank secured to its mounting.

If you can locate a very small American Flag, its staff can be glued into a small hole in Sam's right hand and besides appearing patriotic, it will provide a beneficial drag to help keep the lines tight.

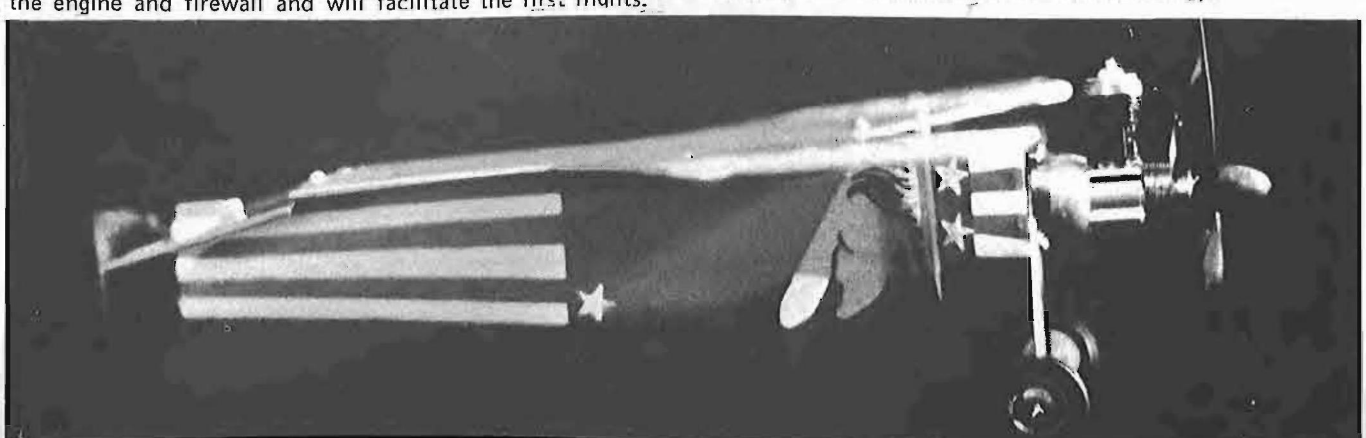
About all that remains at this point is to bolt your engine to his hat, sort of a Babe-Bee on his bonnet! Check that the model balances as shown on the plan, and wait for a calm day to try it out. Though it may detract from appearance, a simple landing gear may be mounted between the engine and firewall and will facilitate the first flights. Otherwise, you'll have to hand-launch and fly over grass.

I think that you will find our Uncle Sam is now a fine flyer as well as the splendid fellow that we have always known.

MATERIALS LIST

1—1/4" x 3" x 36" (.18" if you have it) balsa for fuselage; 1—1/8" x 3" x 36" balsa for wing; .045 wire for pushrod. Elmer's glue, or model cement for wood; fuel-proof dope; clear, red, white, blue, and black; thinner, brush, masking tape. Cox .049 Babe-Bee engine. 1 sheet 1/8" plywood. 3-48 x ½" mounting bolts, blind mounting nuts; ½A bellcrank and elevator horn.

As an alternative to the hardware and plywood listed at the end of the above list, Sterling Models, Belfield Avenue and Wister St., Philadelphia, Penn. 19144, has a complete packet of hardware, including aluminum firewall brackets, for those of you who may be stumped by cutting plywood, made for the "Beginner's Ringmaster" S-13, at a cost of 65 cents (plus 60 cents for postage and handling).



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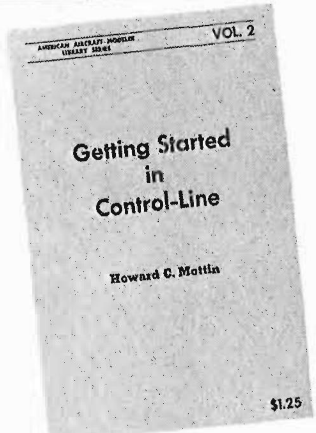

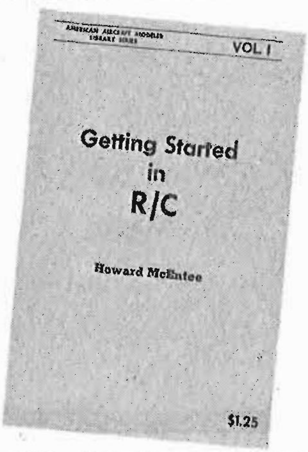

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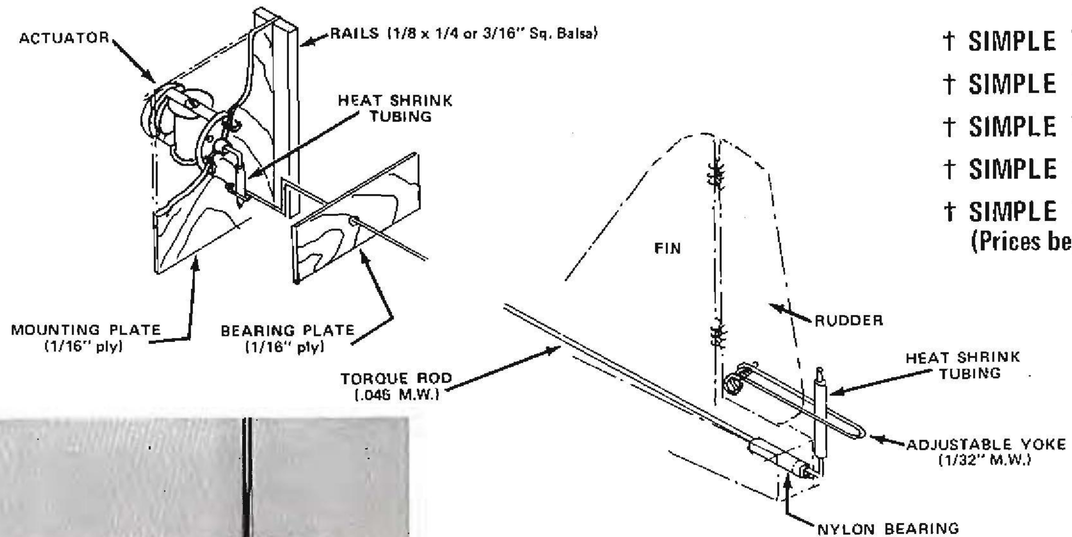

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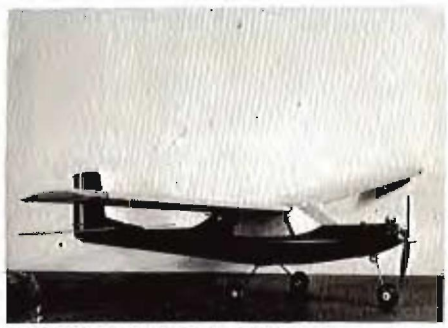

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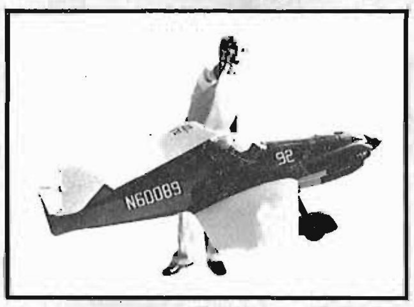

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